OCTOBER, 1953

# APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS

## NATIONAL CONFERENCE on INDUSTRIAL HYDRAULICS Chicago • October 8-9

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## ANNOUNCING the APPLIED HYDRAULICS PRIZE WINNING PAPERS

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FRANCHISE CIRCULATION

Listed on page 2 you'll find 14 articles and 7 regular departments which feature application and design ideas for fluid power equipment

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OCTOBER, 1953
Vol. 6, No. 10

# APPLIED HYDRAULICS

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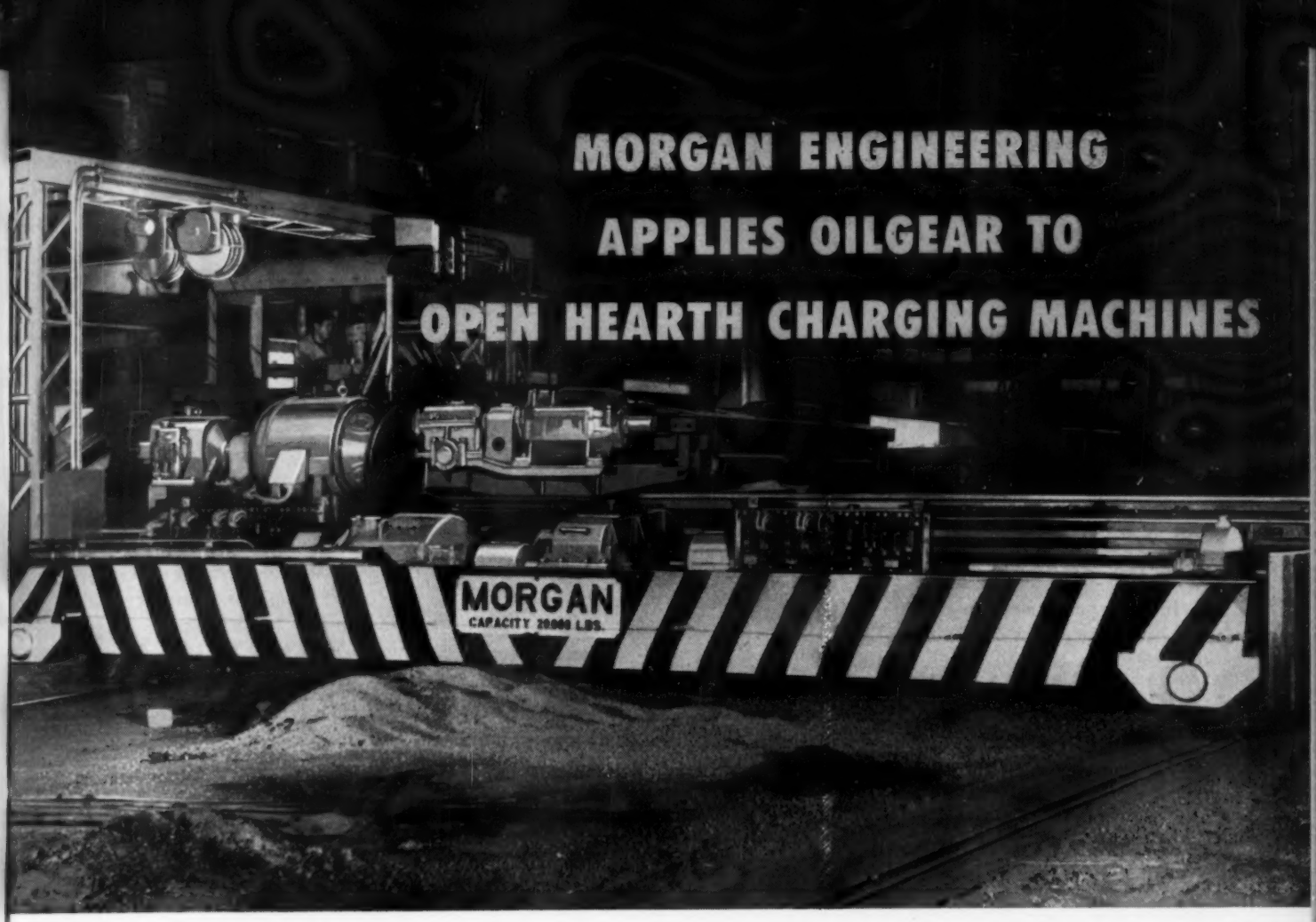


## Gains Longer Life, Greater Visibility, Safety and Simplified Design

It has been said that for a number of years very few improvements have been made in open hearth charging machines used in steel mills. Here too a consideration of Oilgear Fluid Power equipment led to some valuable and important progress.

The Morgan Engineering Company, a leading manufacturer in the field, decided that much could be gained by the use of oil hydraulics and designed its 10-ton charging machine accordingly. Morgan uses the following Oilgear Fluid Power equipment: a hydraulic pump with a volume of 60 gallons per minute at 1700 psi pressure; 2 hydraulic cylinders for the hoist; one cylinder for the peel clamping device; two 4-way control valves located near the pump operated in turn by two pilot valves in the operator's cab; and a cam operated relief valve on the peel clamping device.

The company gained the following advantages: on the hoist, the conventional large hoist motor with its reduction unit is eliminated giving the operator maximum visibility and of course surer operation. The hydraulic cylinders used eliminate the conventional crank motion used hitherto exclusively.

The peel clamping device is actuated by one hydraulic cylinder, felt to be a definite improvement. It was found that hydraulic clamping is adequate by itself and the usual locking device was eliminated. More important, hydraulic clamping prevents oscillation of the boxes while the peel is being rotated and this prolongs the life of both peel head and boxes.

The cam operated relief valve is a safety measure, preventing the operator from lifting the box until the locking rod has been correctly located in the box head well.

Since this application has proved so satisfactory, the Morgan Engineering Company has applied Oilgear Fluid Power Equipment to other types of charging machines, to hot saws, inverted and portable strippers as well.

Designers should bear in mind the advantages cited above are in addition to the fundamental Oilgear advantages of flexibility, wide range of power, infinitely and steplessly variable speed range, unlimited ratios, smooth cushioned acceleration and shockfree hydro-dynamic braking, simplified and accessible hydraulic design well ahead of J.I.C. standards, a range of application from the handling of the most delicate and fragile webs up to the most massive power requirements. You are invited to submit your problem to Oilgear. It will cost you nothing to do so; it may prove to be one of the most profitable steps you have ever taken. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wisconsin.

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# Fluid Power Lines

## Prize Papers Awards

In the special section of this issue, announcement is made of all winners in the APPLIED HYDRAULICS Prize Paper Contest. This contest which was announced last November and closed June 1st attracted over 50 entries. Winners were selected by a board of three judges: Dean M. Cleaveland, Bendix Products Division of Bendix Aviation, Walter Ernst, The Commonwealth Engineering Company of Ohio, and J. R. Hemeon, Ternstedt Division of General Motors Corporation.

Along with announcement of the prize winners and the papers awarded Honorable Mention, three papers are published in this issue. Other prize winning papers will appear in coming issues.

## NCIH Program

Each year during the National Conference on Industrial Hydraulics we wish we could be in three places at the same time so that we could hear all the papers. Since this is impossible, we study the program and the abstracts to decide which meetings to attend and then hope we've picked the ones with the best speakers and the liveliest panel discussion.

During the first afternoon there are concurrent sessions on automotive applications of hydraulics, presses and pumps. The next morning it'll be aircraft, machine tools and components, and in the afternoon we'll again wish we could be in three places at once to attend the meetings on nonflammable oils, tractors and instrumentation.

In this issue you'll find the complete program and abstracts of most of the papers to help you decide which meetings to attend or which papers to request.

## High Horsepower Systems

Arthur Greensite, Design Engineer for Loewy Construction Co., Inc., has prepared a series of articles detailing design aspects of hydraulic systems on heavy presses. Part 1 of the series appears in this issue. Recent development of presses having ratings of 20,000 tons and up has required new designs of power units, valves, safety devices and other components. All these design requirements will be discussed in Mr. Greensite's series of articles.

## Packaging with Air

In the preparation of Bob Taggart's article describing the design of an air powered packaging machine, we had the chance to visit the Lynch plant in Toledo where Bob is chief engineer. For the machine designer who is fascinated by making tricky mechanical drives, the design of high speed packaging machinery will keep him happy. Most of the equipment is entirely mechanical. The machine described in Bob's article is one of the first where the mechanisms are air powered. Use of an electrically controlled air system greatly simplifies the machine over its mechanical counterpart. It also does a better job. Motions on most packaging machines are too complex to permit complete application of air power. However, the designer of packaging machinery is keeping familiar with fluid power techniques to apply them where they will result in a better machine.

## Salad Oil Will Do . . .

. . . not only on salads but in hydraulic systems. This bit of news isn't going to worry any hydraulic oil producer because hydraulic systems won't digest salad oil on a steady diet. The stuff's also expensive for that purpose. What brings forth this valuable bit of information is a little news story we just read and Bob Sharpe's article "Do You Need Inhibited Oils?" which appears in this issue.

The news story told of Captain Austin J. King who circled his C-46 around Seoul airport while he tried to lower his landing gear by hand. The plane's hydraulic system was out of order. After wrestling with the mechanism for 90 minutes he noticed the cargo—salad oil. King poured the oil into the hydraulic system; the gear lowered and the plane landed safely.

Bob Sharpe's comprehensive article will give you a great amount of information on inhibited oils. Since he didn't include salad oil we thought we'd better add this note.

## Servo Design

This issue includes Part 2 of F. B. MacLaren's series of Servomechanisms. Design factors influencing the selection of components are discussed. Part 1 which appeared in the August issue discussed basic terms, types of servos and performance. Industrial applications of these servos will be presented next month.

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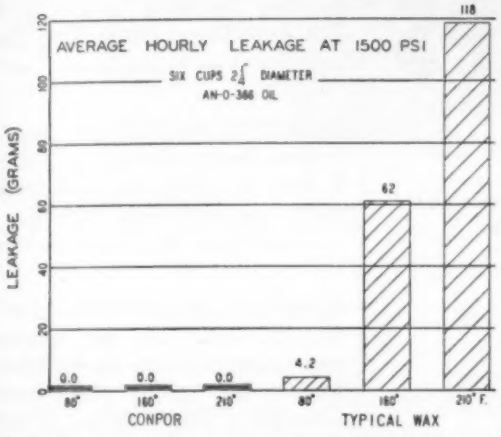


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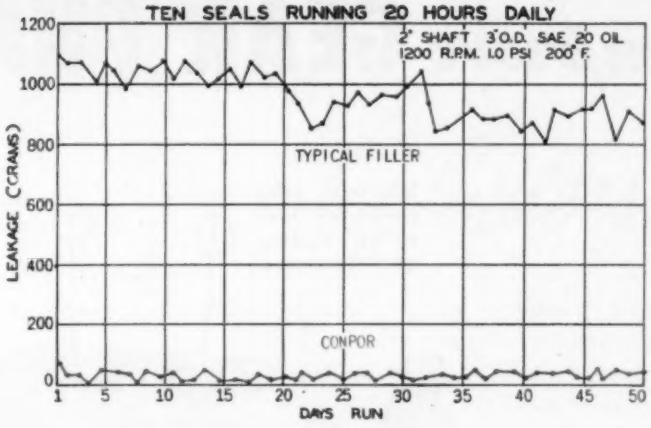


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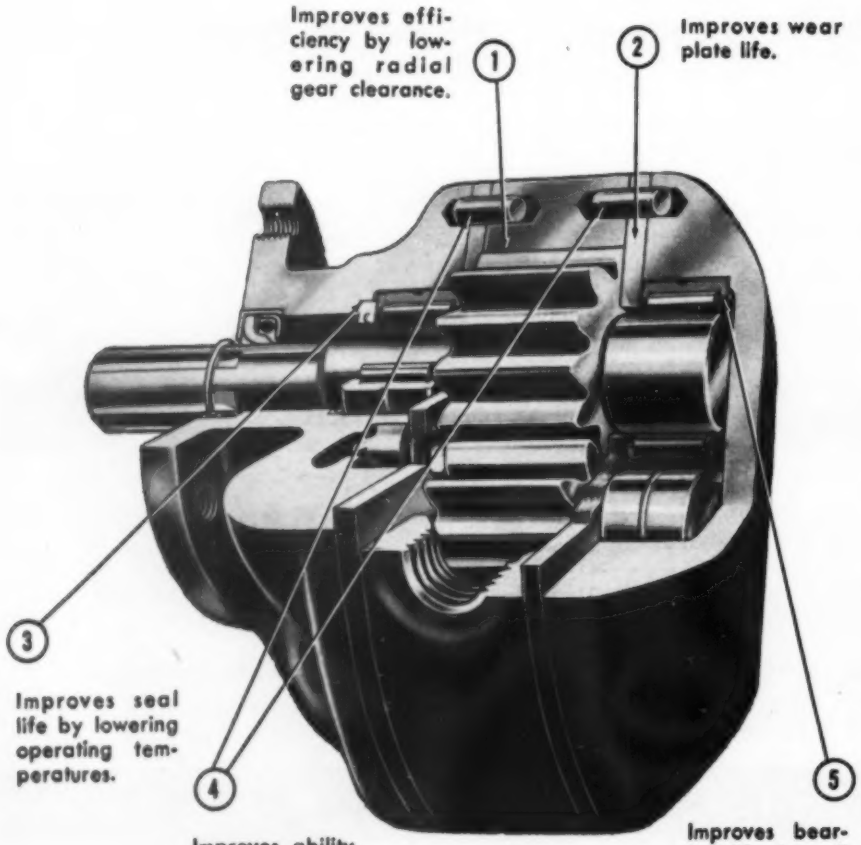


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PISTON RINGS for compressors, hydraulic cylinders and valves are detailed in data available from The Auto-Diesel Piston Ring Co.
Circle 16 on Reader Service Card

CONTROL VALVES are described in data sheets offered by C. B. Hunt & Son, Inc. They are used in pneumatic and hydraulic systems.
Circle 92 on Reader Service Card

BEARINGS, BUSHINGS and WEAR PLATES—you can get quotations and recommendations for alloy selection by writing the American Crucible Products Co., Literature on these products is available.
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PRESSURE REDUCING VALVES handling air, oil or water at pressures as high as 6,000 psi are described in bulletins offered by Atlas Valve Company.
Circle 15 on Reader Service Card

AIR FILTERS, aftercoolers and separators, to protect and increase the efficiency of air circuits are described in Bulletin 176 prepared by R. P. Adams Co., Inc.
Circle 5 on Reader Service Card

HYDRAULIC HOSE ASSEMBLY catalog is available from Carlyle Rubber Company, Inc. Flexible, high pressure, wire braided hose assemblies are presented.
Circle 30 on Reader Service Card

AIR CYLINDER information on parts, prices, dimensions, specifications, mounting styles and construction, is contained in Bulletin No. 100. HYDRAULIC CYLINDER bulletins No. 750 and No. 1500, on both the 750 psi series and the 1500 psi series contain essential ordering information. Available from Carter Controls.
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Continued on page 10

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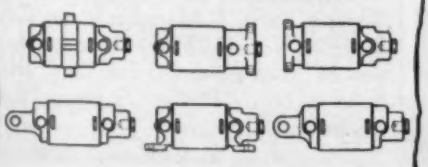

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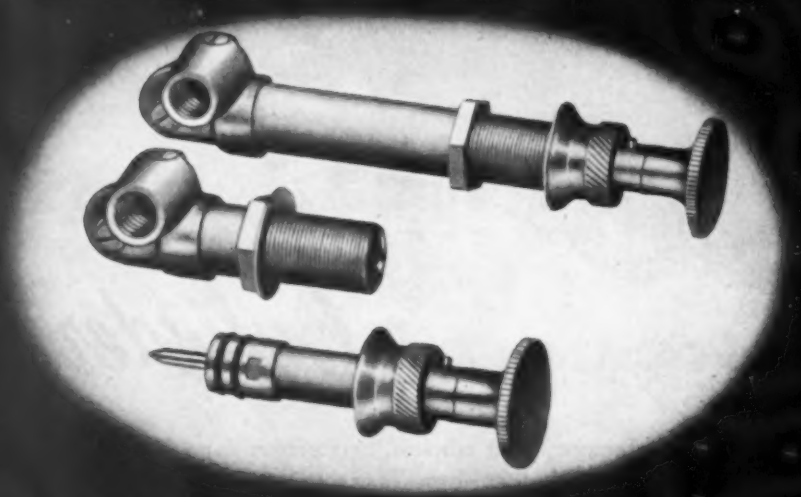

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PACKING for air, and hydraulic cylinders, and reciprocating pumps, is described in bulletins offered by Darling Valve & Manufacturing Co. Bulletin No. 4502 on Pumcups for air or hydraulic mechanisms and Bulletin No. 4401 on Pumcups for reciprocating pumps.
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Continued on page 14

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AN6230 "O" RING GASKETS
AN6290 FITTING GASKETS
AN123851 (AMS7274) SERIES, and
AN123951 (AMS7270) SERIES
OIL and FUEL RESISTANT "O" RINGS
AN902 FLARED TUBE GASKETS

Approved "AN" "ASTM", "MIL", "AMS" compounds. Write for GRC "O" Ring Handbook.

*Mechanical* **RUBBER GOODS** *by* **Goshen**

Make Goshen your ONE dependable source for rubber and synthetic parts and hydraulic O-Rings. We are specialists in producing large or small quantities, whether stock molds or items to customers' specifications.

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Goshen is a dependable source for fast, accurate die-cutting of rubber parts . . . gaskets, spacers, shims, seals, washers . . . in a great variety of shapes, sizes, compounds . . . in large or small quantity. Die-cuts in single and double-ply fabric-inserted (cotton, nylon, etc.) neoprene; red sheet packing; reclaimed packing sheet; sponge rubber; neoprene cork; asbestos materials; others.

PRECISION *die cutting*

On any die-cut problem we'll be glad to consult with you and to furnish quotations . . . without obligation. Write . . .

QUALITY ENGINEERED GOSHEN 'O' RINGS

*Goshen Grommets*

AN-931 GROMMETS. Approved compound MIL-G-3036. Available in all sizes. Also a great range of special sizes and shapes in a wide range of compounds . . . from stock molds or custom-engineered.

*Write for Grommet Catalog*

*Goshen Rubber Co.* INC. *Goshen, Indiana, U.S.A.*

MOLDED · DIE CUT · LATHE CUT · RUBBER SPECIALTIES SINCE 1914

*announcing*

# HYDROTOR®

*the NEW revolutionary*

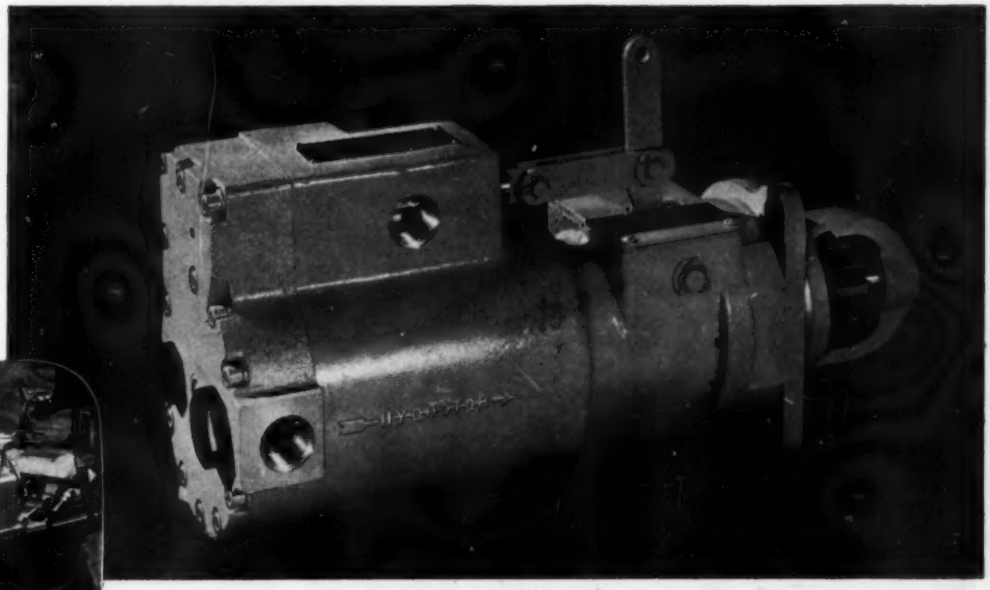
## HYDRAULIC CRANKING MOTOR

### for diesel and gasoline engines

**FARM • INDUSTRIAL • MILITARY • MARINE**

**3 SIZES TO FIT ALL NEEDS**

- Model CM1
- Model CM2
- Model CM5



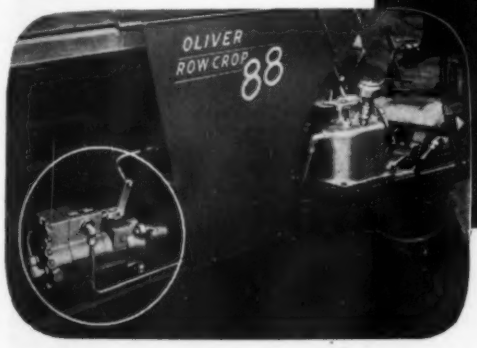



Illustration at left shows installation of HYDROTOR MODEL CM-2 on OLIVER ROWCROP 88 (Hydrotor in circle)

## higher cranking speeds...more efficient starting...arctic to tropics

**EFFICIENT DEPENDABLE CRANKING AT ALL TEMPERATURES IN ALL CLIMATES.** The same HYDROTOR-equipped units operating through the winters of Northern Manitoba operated with equal success through the summer on the sands of Yuma, Arizona without adjustment or even changing the hydraulic medium.

**HIGHER CRANKING SPEED WITH LESS BULK AND WEIGHT.** The HYDROTOR has the high torque characteristics of hydraulic motors. Aluminum and bronze construction provide durability with a minimum of weight.

**A PRACTICAL REPLACEMENT FOR ORDINARY CRANKING SYSTEMS.** Smaller and lighter, yet more powerful than electric or pneumatic starters. The three models of HYDROTORS are furnished with SAE mounting pads for replacement purposes.

**TWO CRANKING SYSTEMS IN ONE.** The HYDROTOR used in combination with a recharging pump provides automatic cranking with the hand pump available for emergency use.

**PROTECTION WHILE OPERATING IN HAZARDOUS AREAS.** The HYDROTOR, being non-electric, is completely explosion proof.

**ADJUSTABLE CRANKING SPEED.** The HYDROTOR will operate over a wide speed range from rotation slow enough to adjust timing or free engine up to maximum rated speed.

**MINIMUM MAINTENANCE.** The HYDROTOR operates in a closed hydraulic system completely independent from batteries. Energy to crank the engine can be readily restored to the accumulator through the hand pump. There is no "dead-lining" due to failure of batteries or air receivers. Specify "HYDROTOR" Cranking Motor on all new equipment.

**Write for more complete details and literature today.**

**HYDRAMOTIVE, INC.**

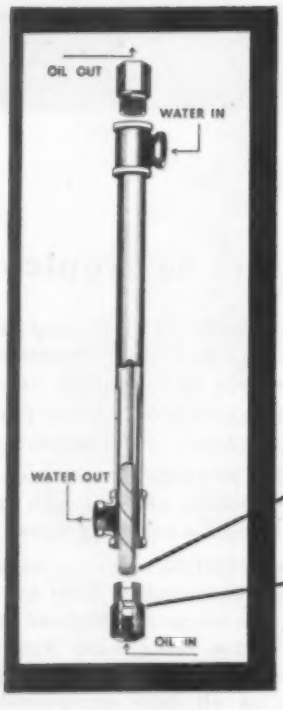
2323 EAST 67TH STREET — CLEVELAND 4, OHIO

# Something New in Oil Cooling

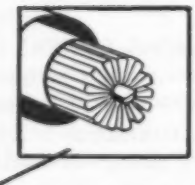
## heat-x INNER-FIN OIL COOLERS

**Longitudinal inner-fin construction, exclusive with Heat-X, makes possible this compact, economical oil cooler. Generous inner-fin surface permits more cooling in less space . . . with minimum pressure drop.**

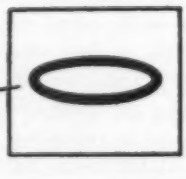
**Unequalled for many applications, including hydraulically operated machines, turbines, diesel and gasoline engines, torque convertors, gears, compressors, transformers and similar applications.**




**Oil flows through the inner-finned tubes, water counterflows through the shell. Available in several sizes, with oil flow rates up to 60 G.P.M.**



Inner-finned element is all copper and is easily removable for cleaning or replacement.



"O" rings provide positive seal between oil and water . . . eliminate all soldered and packed joints and gaskets

REQUEST FREE ILLUSTRATED BULLETINS.

INNER-FIN IS A PATENTED HEAT-X DEVELOPMENT.

**THE HEAT-X-CHANGER CO., Inc.**

BREWSTER - NEW YORK


## *Free Literature Offered in this Month's Ads*

Continued

"O" RING catalog is designed for broadest usefulness in all industries utilizing "O" rings. Contains complete information on dynamic and static application of "O" rings. Illustrated, lists all commercial grade "O" rings and back-up rings. Available from National Motor Bearing Co.

Circle 125 on Reader Service Card

SOLENOID VALVES are described in a booklet "The Valcor Solenoid Valve with the Floating Shear Seal" offered by Valcor Engineering Corp.

Circle 187 on Reader Service Card

"O" RING catalog complete with design and installation data is offered by The Darcoid Company, Inc., manufacturers of custom molded products.

Circle 46 on Reader Service Card

PNEUMATIC CYLINDER MOTORS for throttling control, operating on air pressures up to 100 psi are described in Bulletin B-50-AH, prepared by Conoflow Corporation.

Circle 42 on Reader Service Card

TENSION LINKAGE BULLETIN includes typical examples of tension linkage applications, data on equipment selection and tables of dimensional data. May be obtained from Baldwin-Duckworth, Division of Chain Belt Company.

Circle 35 on Reader Service Card

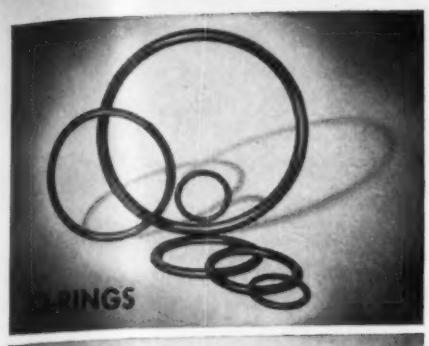
FLAME-RESISTANT HYDRAULIC FLUID is described in a bulletin available from Celanese Corporation of America. Lindol HF as an additive to regular petroleum lubricants and to synthetic lubricants improves lubrication value.

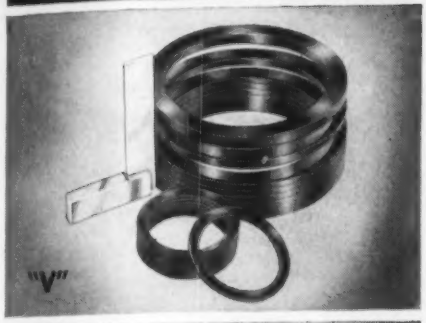
Circle 33 on Reader Service Card

HYDRAULIC HOSE COUPLINGS AND FITTINGS are described in Catalog 101, available from Eastman Manufacturing Company.

Circle 59 on Reader Service Card

Continued on page 18



## CUP PACKINGS

Made of leather or rubber. Installed on piston head or backing plate. Sealing lip and outer side wall form dynamic seal on cylinder wall. Follower plate forms compression seal on bottom of cup. Expanders adaptable when needed.

# Symbol Numbers or Problems . . . you'll get packings satisfaction at G & K - INTERNATIONAL

Whether you order packings by the JIC Standard Dash Number or furnish specifications to meet unusual conditions, you'll find G&K-INTERNATIONAL able and eager to meet your needs.

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Be sure your packings are *right* for your installation. Order them from the packings *specialists* — G&K-INTERNATIONAL!



**New Packings Catalog**

This is more than a catalog. It covers all standard packings in leather and rubber with JIC and IPC tables, and includes data on applications. We'd like to send you a copy. Write for it today!

G&K GRATON AND KNIGHT INTERNATIONAL

**GRATON & KNIGHT COMPANY**
*Established 1851*
**Worcester 4, Massachusetts**

**INTERNATIONAL PACKINGS CORPORATION**
*Graton & Knight Company Affiliate*
**Bristol, New Hampshire**

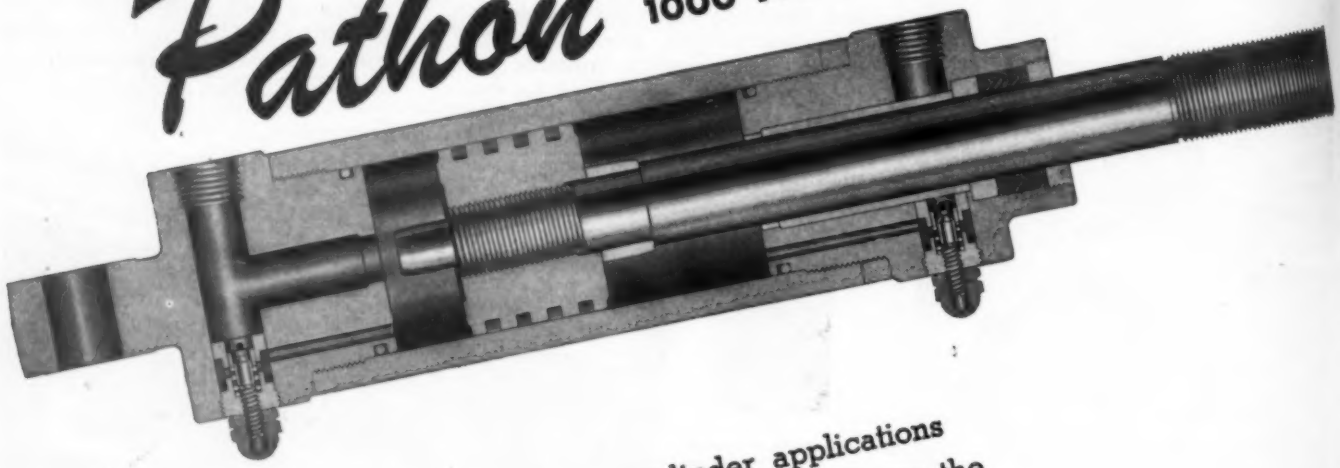
P-5

# Compactness

## IS THE RULE ON ALL

# Pathon

**SERIES R H 2000 P.S.I. and SERIES Q H 1000 P.S.I. HYDRAULIC CYLINDERS**



On all of your hydraulic cylinder applications the appropriate Pathon cylinder will give you the minimum in mounting size with increase strength and fatigue life.

## A PATHON HYDRAULIC CYLINDER HAS . . .

**LOW STRESS CONCENTRATION** through the head to barrel attaching area providing a plus factor for shock loads. The single screw thread attaching method gives maximum strength in minimum space.

Our new thirty-two page bulletin covering these cylinders is now being distributed. Write for your copy.

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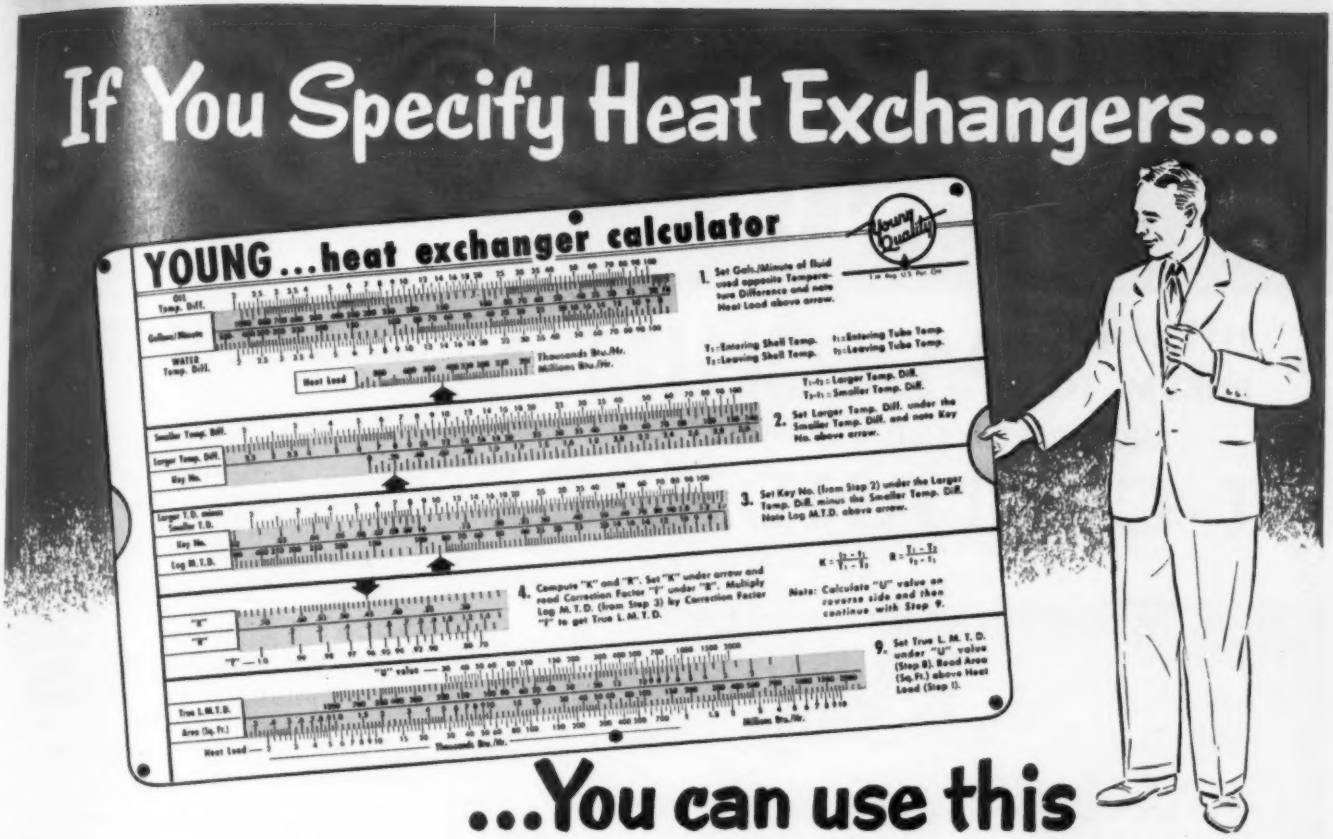
**AIR CYLINDERS...HYDRAULIC DIRECTIONAL CONTROL VALVES...HYDRAULIC CYLINDERS**

# If You Specify Heat Exchangers...


YOUNG...heat exchanger calculator
Young Quality
1. Set Gals./Minute of fluid used opposite Temperature Difference and note Heat Load above arrow.
2. Set Larger Temp. Diff. under the Smaller Temp. Diff. and note Key No. above arrow.
3. Set Key No. (from Step 2) under the Larger Temp. Diff. minus the Smaller Temp. Diff. Note Log M.T.D. above arrow.
4. Compute "K" and "R". Set "K" under arrow and read Correction Factor "F" under "R". Multiply Log M.T.D. (from Step 3) by Correction Factor "F" to get True L.M.T.D.
Note: Calculate "U" value on reverse side and then continue with Step 9.
9. Set True L.M.T.D. under "U" value (Step 8). Read Area (Sq. Ft.) above Heat Load (Step 1).

## ...You can use this

# NEW YOUNG HEAT EXCHANGER CALCULATOR

AN EASY WAY TO SELECT THE CORRECT UNIT FOR YOUR JOB
Single pass, fixed tube bundle, 74 stock models
Two and four pass, fixed tube bundle, 100 stock models
Single pass, removable tube bundle, 258 models
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This exclusive Young Heat Exchanger Calculator is an engineering tool specially designed to help you calculate and specify Young shell and tube Heat Exchangers. Designed to save you time, the Calculator enables an engineer to determine quickly individual heat transfer coefficients for the shell side and tube side, and by combining them with suitable fouling factors to determine over-all heat transfer coefficients. It also gives you a visual picture how the size of a Heat Exchanger will vary with fluid temperatures and velocities.

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**Heating, Cooling, Air Conditioning Products for Home and Industry**
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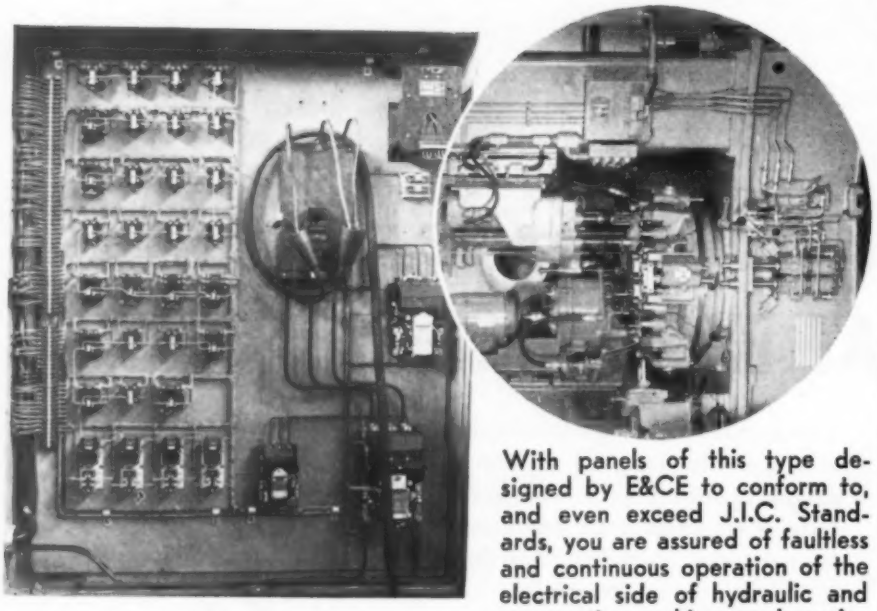
Circle 196 on Reader Service Card

# ELECTRICAL CONTROLS

for HYDRAULIC PNEUMATIC **MACHINES**

ENGINEERED AND DESIGNED TO

# J-I-C STANDARDS



With panels of this type designed by E&CE to conform to, and even exceed J.I.C. Standards, you are assured of faultless and continuous operation of the electrical side of hydraulic and pneumatic machines and equipment.

- Hydraulic and pneumatic power combined with automatic electric or pneumatic controls can play a major part in improved performance of your machinery and equipment, *if the entire system is coordinated.*
- Equipment & Controls Engineers can design and engineer a complete package, enabling you to centralize responsibility with the additional assurance of having the most modern equipment of this type, engineered by men having years of experience in this specialized field.
- **Our staff of experienced engineers, combined with the experience of our entire Organization is available to you on a consulting as well as on a contractual basis.**

**EQUIPMENT & CONTROLS ENGINEERS, INC.**

812 Noblestown Road · PITTSBURGH, PA.


## *Free Literature Offered in this Month's Ads*

Continued

**HYDRAULIC FLUID STRAINERS** offering non-stop filtration, with no need for a stand-by strainer, and pressures up to 3000 psi are presented in a bulletin available from Cuno Engineering Corporation.

Circle 45 on Reader Service Card

**FITTINGS** which require no flaring, welding, threading or soldering are described in Ermeto Catalog E-1457 by The Weatherhead Company.

Circle 194 on Reader Service Card

**CONTROLS** available for pressure, flow, temperature and weight. Complete technical information can be supplied by writing Control Engineering Corporation.

Circle 43 on Reader Service Card

**HYDRAULIC and PNEUMATIC LEATHER PACKINGS** is the subject material of a 64 page book, available from Chicago Belting Company, manufacturers of leather packings, mechanical leathers, coupling discs, gaskets and washers.

Circle 36 on Reader Service Card

**HYDRAULIC PISTON RINGS** and piston groove specifications are covered in literature and chart form, available by writing Double Seal Ring Co.

Circle 54 on Reader Service Card

**SPEED CONTROL VALVE** manufactured by Electrol Inc. will handle air, oil or water, with operating pressures up to 1500 psi. The company invites inquiries regarding this equipment.

Circle 63 on Reader Service Card

**SELECTOR** for rubber covered hydraulic hose may be obtained from Republic Rubber Division. The slide is moved until the needed ID size shows the arrow or any known factors on the selector. The slide fits into a pocket conveniently.

Circle 153 on Reader Service Card

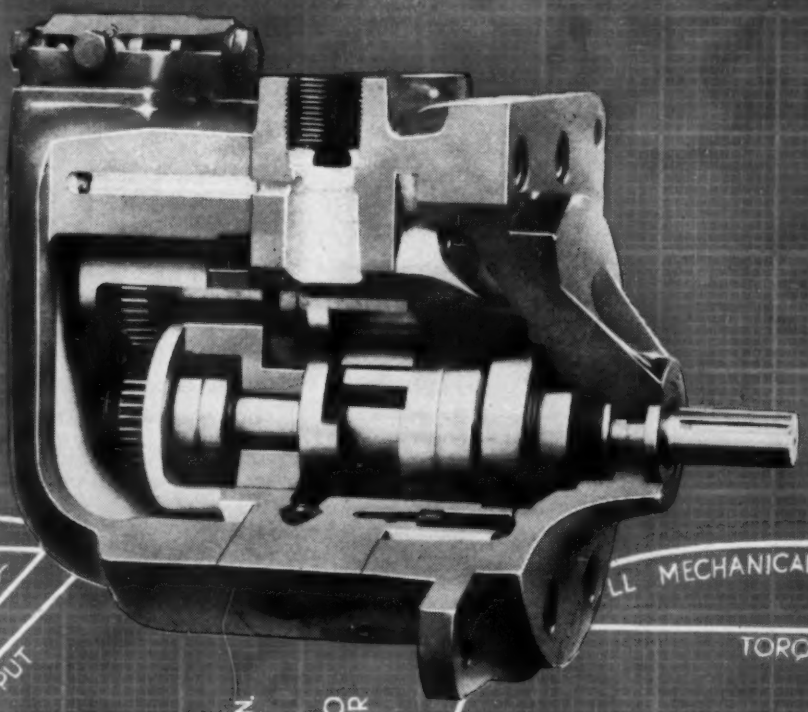
Continued on page 22

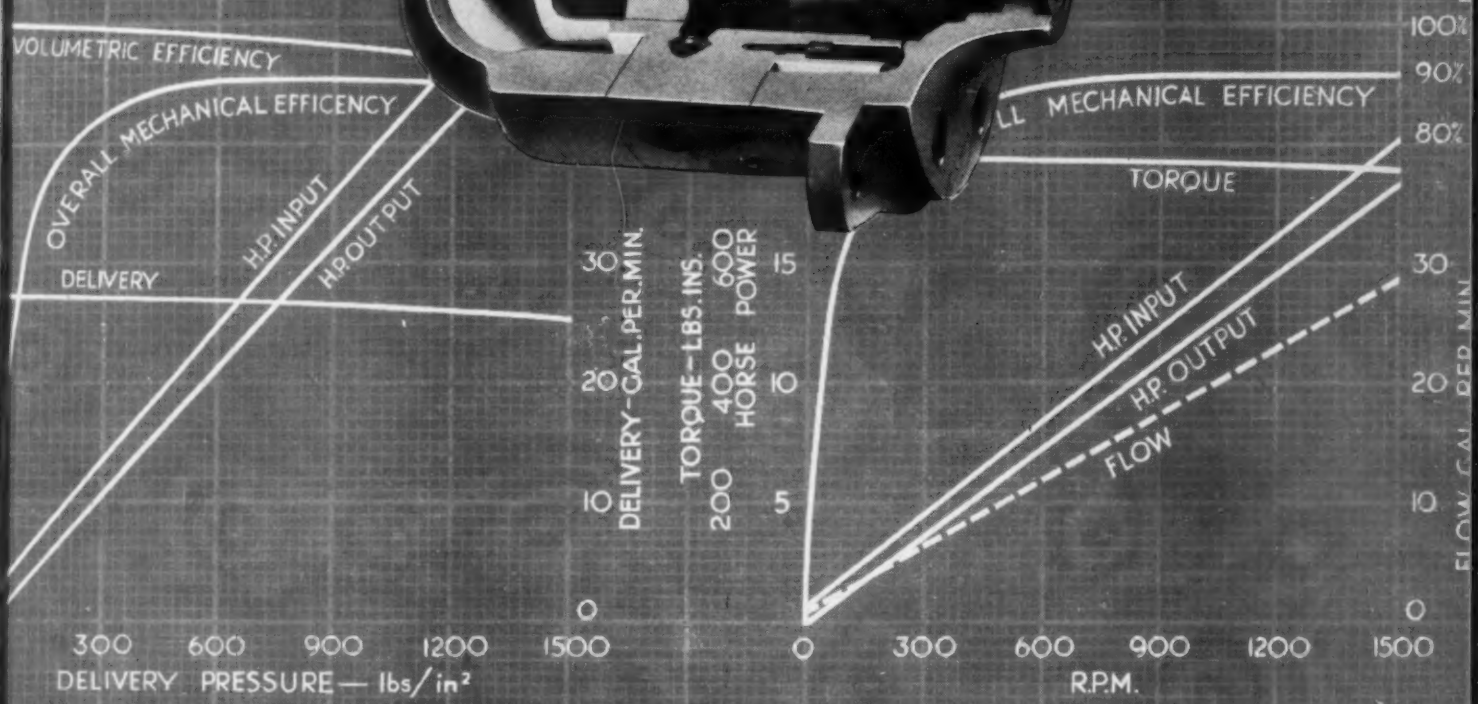


Circle 64 on Reader Service Card

Circle 103 on Reader Service Card →

# ROTARY ABUTMENT UNITS






**TYPE 502 PUMP AT 1500 R.P.M** **TYPE 502 MOTOR AT 1000 lbs/in²**

**Keelavite** *hydraulics*

*For high performance with economy*

**THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION**

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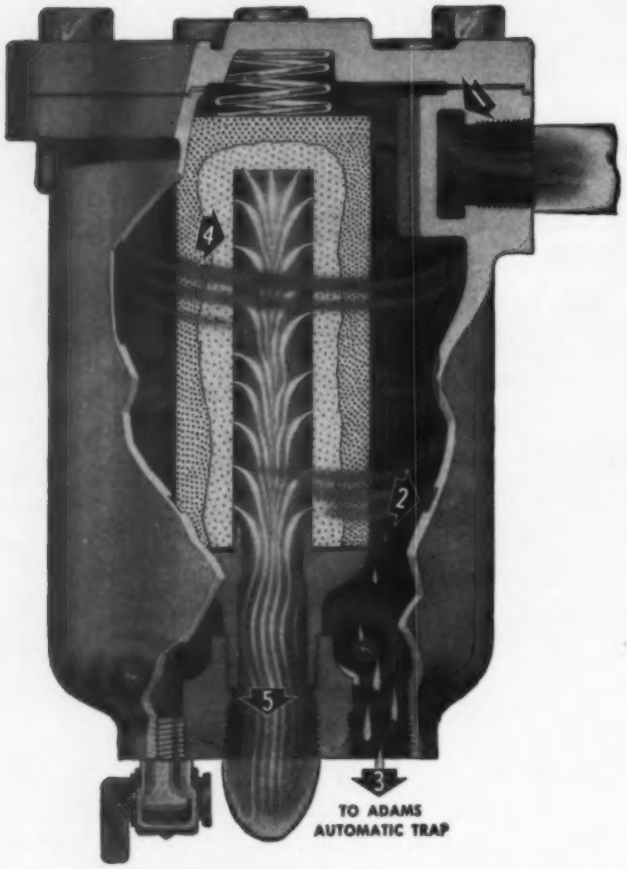
Sales Representatives for Canada, Cosaire Limited, P.O. Box 84, Municipal Airport, St. Catherines, Ontario.

*Cogent*

# ADAMS *has both* *




## —— BOTH ANSWERS TO THE PROBLEM OF KEEPING WATER, WATER VAPOR, OIL AND DIRT OUT OF COMPRESSED AIR LINES

There's no *one* answer to this problem! The most expensive aftercooler you can buy will not remove scale that is picked up in the distribution lines. The most expensive air filter you can buy cannot guarantee removal of water vapor until it has been condensed by cooling. That's why Adams makes both.

## * PORO-STONE *AIR FILTER*

1. Centrifugal separation of dirt and liquids.
2. Drainage to trap directed by vertical cast-in slots.
3. Continuous, fully automatic trap action.
4. Rapid diffusion and filtration through permanent, cleanable Poro-Stone.
5. Clean, dry air at practically unchanged pressure. Standard, stocked sizes handle from 10 to 700 cfm.

Easily installed in either vertical or horizontal pipe line.

## *AFTERCOOLER AND CYCLONE SEPARATOR

Cools air to within a few degrees of cooling water, making certain that compressed air is colder than surrounding atmosphere, so that no further condensation can take place.

Counter flow, air-through-tube design assures continuously high heat transfer rate.

Double cyclonic action deposits all water and entrained oil in moisture chamber.

R. P. ADAMS CO., INC.
249 E. Park Drive, Buffalo 17, New York

Please send me your latest literature, Bulletin No. 176 on BOTH the Poro-Stone air filter and the Adams Aftercooler — Cyclone Separator.

*Name*.....

*Company*.....*Title*.....

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**FOR YOUR PROFIT'S SAKE —FIND OUT ABOUT BOTH**

**R. P. ADAMS CO., INC., BUFFALO 17, N. Y.**

**From Sinclair Research Comes**

# An IMPROVED hydraulic oil

# SINCLAIR DURO

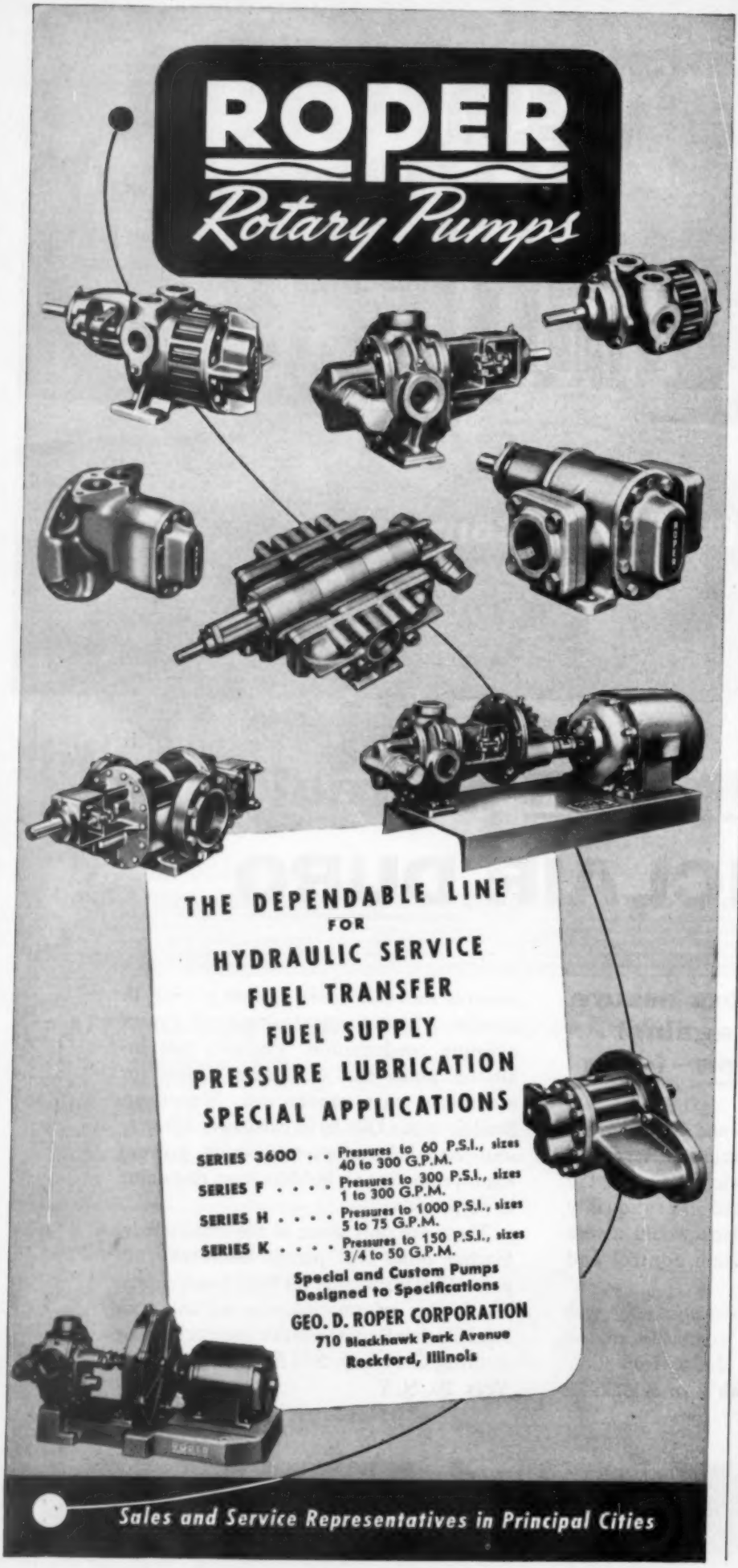
## 4 vital inhibitors assure protection against rust – oxidation – foam

Sinclair DURO Hydraulic and Machine Oil was developed by Sinclair's Research Laboratory, Harvey, Illinois, to meet the requirements and demand for a quality hydraulic oil – an oil which would assure sensitive hydraulic system control and operation.

Sinclair DURO Oils have *unusually high oxidation resistance* to combat corrosive materials, varnish and sludge formation. The inclusion of Sinclair's rust inhibitor *protects metal surfaces* against rusting in systems where frequent shutdown causes moisture condensation. Sinclair's rust inhibitor "plates out" on a metal surface for maximum rust prevention. Moreover, Sinclair DURO Oils have *extremely effective anti-foam characteristics* which prevent foam-promoting air bubbles from remaining in suspension.

These are only some of the reasons why Sinclair DURO Oils permit smoother, full-powered transmission for high productivity. For further information why not call your local Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

# SINCLAIR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Special and Custom Pumps Designed to Specifications
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## *Free Literature Offered in this Month's Ads*

Continued

PACKINGS catalog covers all standard packings in leather and rubber with JIC and IPC tables and includes data on applications. A copy may be secured by writing Graton & Knight Company.

Circle 79 on Reader Service Card

TRAPS for air, gas and steam that never need prime, are described in Catalog 751 offered by W. H. Nicholson & Co.

Circle 129 on Reader Service Card

AIRCRAFT VALVES are covered in a complete catalog made available by Republic Manufacturing Co.

Circle 102 on Reader Service Card

HYDRAULIC PUMP catalog may be obtained by writing Eastern Industries Inc. Gear type fluid motors and high pressure gear pumps are described.

Circle 58 on Reader Service Card

INDUSTRIAL MOTORS are described in Catalog 1080 offered by Electro Dynamic Division of General Dynamics Corp. Motors from 1 to 250 hp are presented.

Circle 60 on Reader Service Card

GROMMET catalog is available through Goshen Rubber Co. Helpful information offered.

Circle 78 on Reader Service Card

FLEXIBLE COUPLINGS catalog contains full technical data, and handy selector charts of types and sizes for all applications, is made available by Lovejoy Flexible Coupling Co.

Circle 115 on Reader Service Card

COUPLINGS bulletin is offered by The Hansen Manufacturing Company. Quick-connective fluid line couplings, and straight-through quick-connective couplings are described in this bulletin.

Circle 87 on Reader Service Card

Continued on page 26

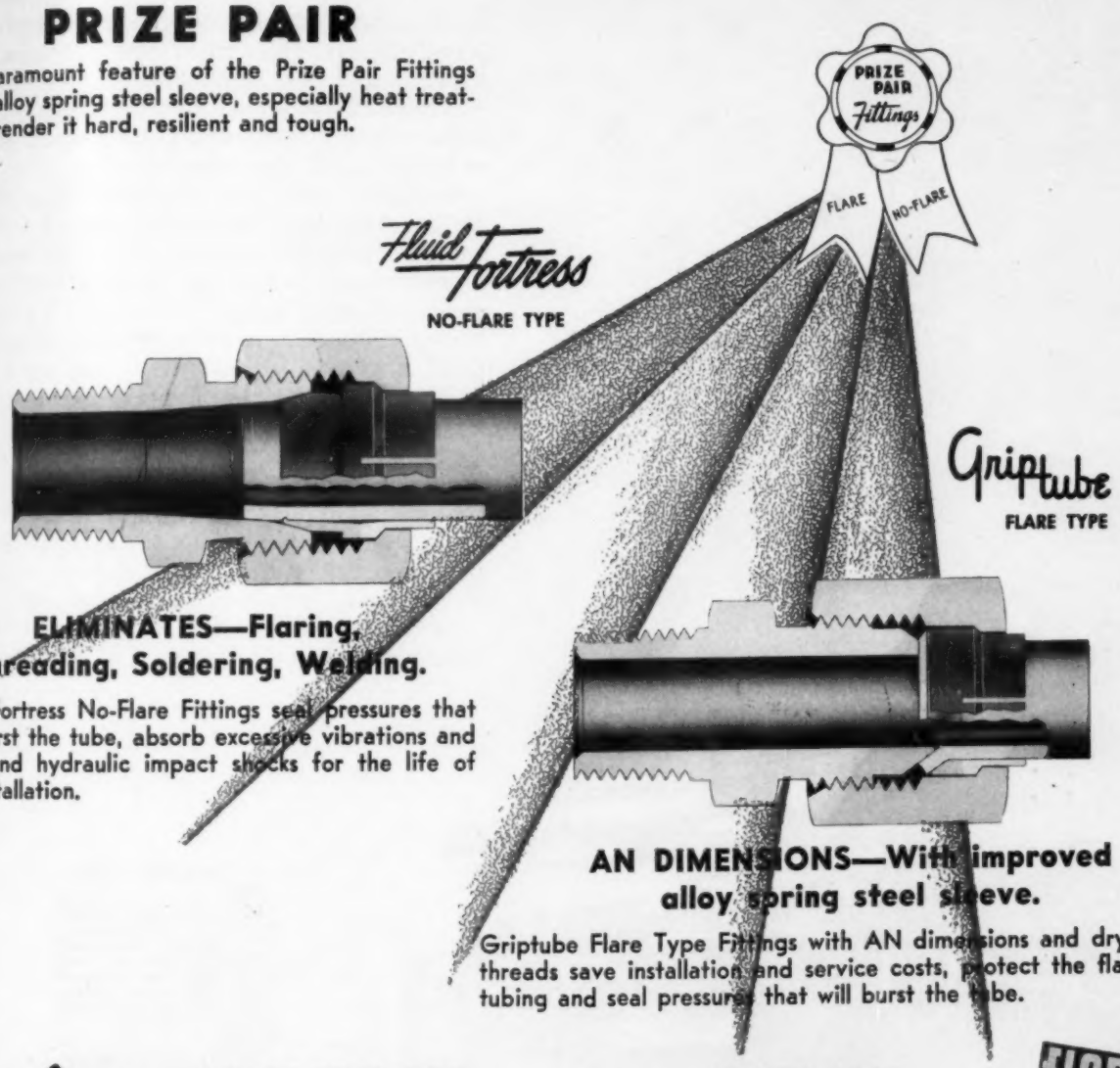
# FLODAR

STANDARD (J.I.C.)

# TUBE FITTINGS

## PRIZE PAIR

The paramount feature of the Prize Pair Fittings is the alloy spring steel sleeve, especially heat treated to render it hard, resilient and tough.

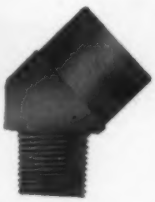



### ELIMINATES—Flaring, Threading, Soldering, Welding.

Fluid Fortress No-Flare Fittings seal pressures that will burst the tube, absorb excessive vibrations and withstand hydraulic impact shocks for the life of the installation.

### AN DIMENSIONS—With improved alloy spring steel sleeve.

Griptube Flare Type Fittings with AN dimensions and dryseal pipe threads save installation and service costs, protect the flare of the tubing and seal pressures that will burst the tube.



### HIGH PRESSURE STEEL PIPE FITTINGS

With Flodar Pipe Fittings the installation man can make a variety of connections involving a large reduction between pipe size and tube outside diameter.

### WRITE FOR NEW 1953 CATALOG

Ask for catalog No. 553 describing complete line of tube fittings, pipe fittings and accessories. Catalog includes important engineering data, installation instructions and tubing recommendations.

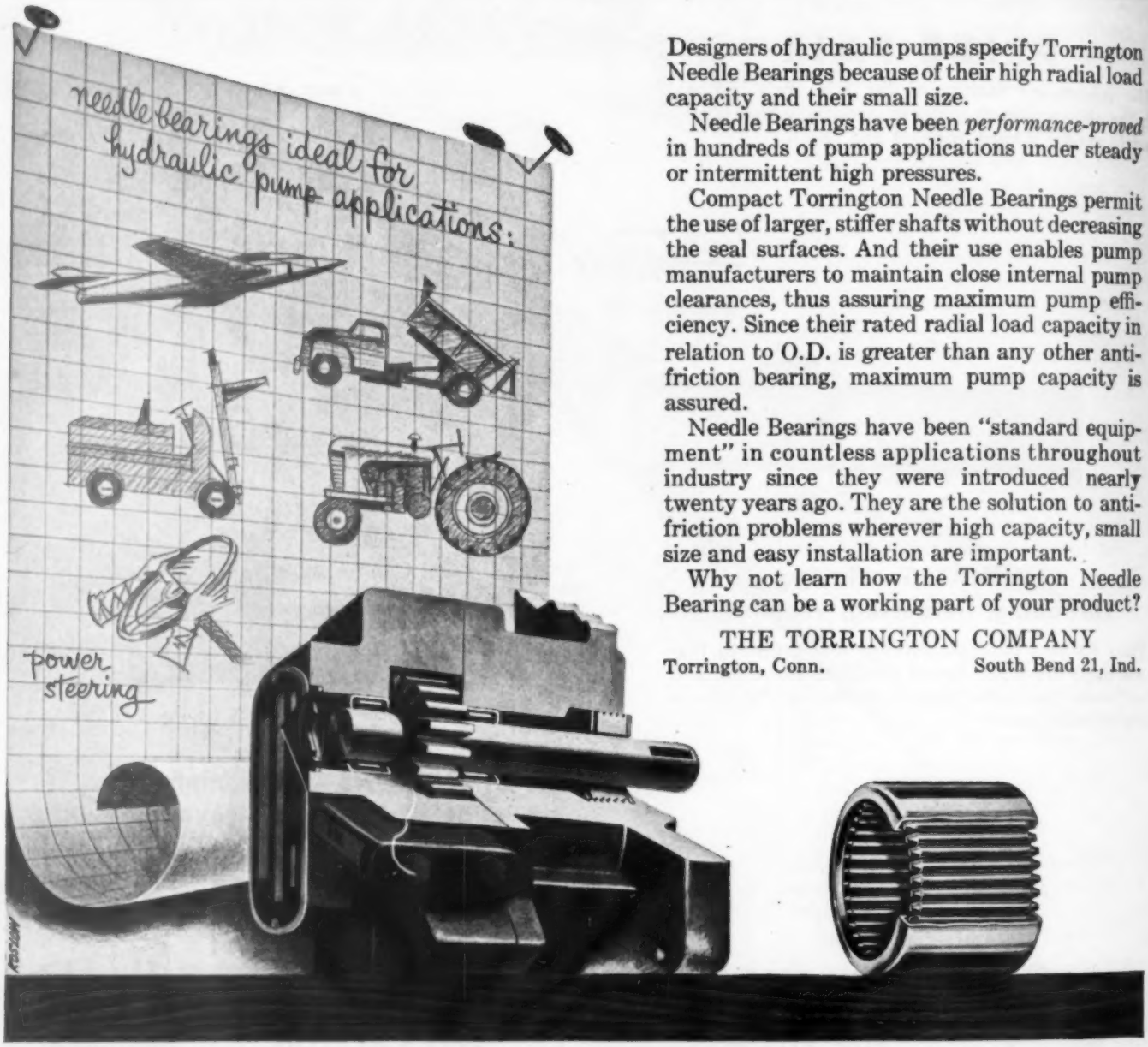
**FLODAR FITTINGS exceed the performance requirements of MIL-F-5506. J.I.C., section H4.1.6**

## FLODAR CORPORATION

1366 EAST 45TH STREET (F) CLEVELAND 3, OHIO

# Need a high capacity bearing with small size?

## *here's how hydraulic pump manufacturers get it with* **NEEDLE BEARINGS**




Designers of hydraulic pumps specify Torrington Needle Bearings because of their high radial load capacity and their small size.

Needle Bearings have been *performance-proved* in hundreds of pump applications under steady or intermittent high pressures.

Compact Torrington Needle Bearings permit the use of larger, stiffer shafts without decreasing the seal surfaces. And their use enables pump manufacturers to maintain close internal pump clearances, thus assuring maximum pump efficiency. Since their rated radial load capacity in relation to O.D. is greater than any other anti-friction bearing, maximum pump capacity is assured.

Needle Bearings have been "standard equipment" in countless applications throughout industry since they were introduced nearly twenty years ago. They are the solution to anti-friction problems wherever high capacity, small size and easy installation are important.

Why not learn how the Torrington Needle Bearing can be a working part of your product?

THE TORRINGTON COMPANY

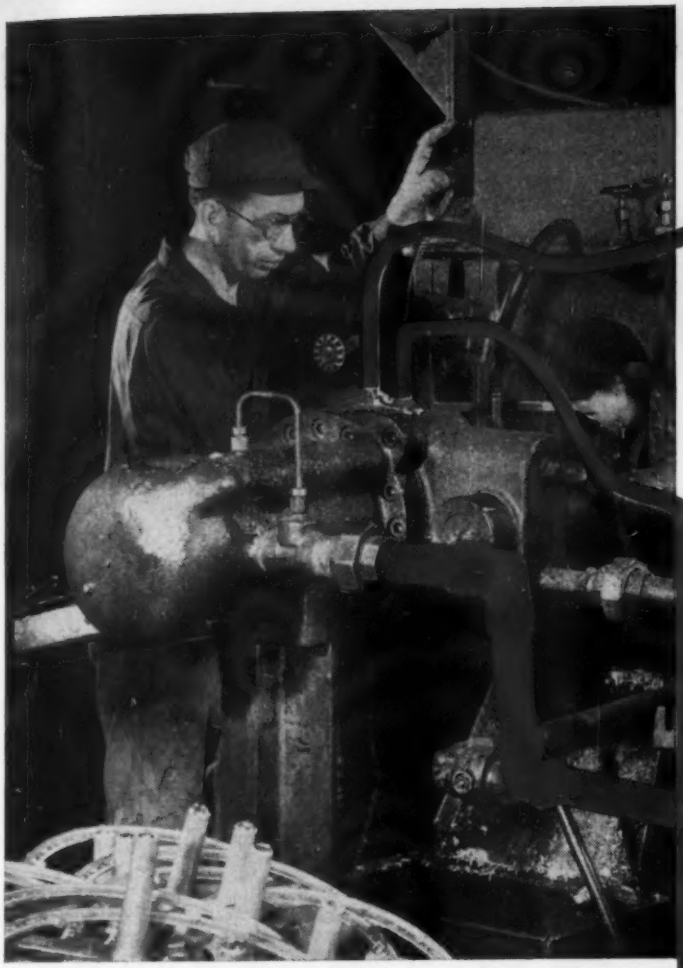
Torrington, Conn. South Bend 21, Ind.

**TORRINGTON** *NEEDLE* **BEARINGS**

Needle • Spherical Roller • Tapered Roller • Straight Roller • Ball • Needle Rollers

*Trade-marks of some of the leading hydraulic pump and motor manufacturers whose products enjoy the benefits of Needle Bearings.*

EATON · Hercules · GEROTOR · HYDRECO · Kingston · WEBSTER ELECTRIC · GW MARION · Pesco PRODUCTS DIVISION



# Fire-resistant PYDRAUL cuts hydraulic fluid hazards

Hydraulically operated machines, like the die-caster in the picture, are often prey to vicious fires that start with a leak in a pressure line. Flammable hydraulic fluid escapes and sprays onto hot metal, turning to liquid flame that can burn or maim personnel, destroy stock and buildings.

Monsanto now provides a simple, effective answer to this problem which has cost American industry millions of dollars a year. Safe, economical Pydraul, a nonflammable-type fluid, is currently employed in more than 100 plant applications—with notable success.

Pydraul, when test-poured on molten metal and sprayed into an oxyacetylene flame, does not flash or ignite. It has high lubricity and is noncorrosive to metal . . . nonvolatile and insoluble in water. Because it requires no special changes in equipment, Pydraul can be introduced into a hydraulic system simply by draining and refilling. **Pydraul: Reg. U. S. Pat. Off*

| NO PYDRAUL HERE | PYDRAUL USED HERE |
|---|---|
| **CASE No. 1** In a Southern steel tinning plant, a break in a hydraulic line released flammable spray that ignited oil. Fire loss: $925,000. | **CASE No. 3** When a hydraulic line parted, the fluid (Pydraul) sprayed into a hot zinc melting pot, splattered several employees. Result: no fire, no injuries, no production loss. |
| **CASE No. 2** In a die-casting plant, rupture of a hydraulic line sprayed fluid over hot machines and gas-fired aluminum melting furnace. Loss: $340,000. | **CASE No. 4** On a new die-casting machine, a hydraulic leak caused by faulty union sprayed Pydraul over equipment and molten aluminum. Result: No fire, no damage. |
| Write today for "Pydraul F-9," an engineering report. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri. | MONSANTO CHEMICALS—PLASTICS |

SERVING INDUSTRY . . . WHICH SERVES MANKIND

Republic
WIRETEX

Rubber Covered
Hydraulic Hose
selector

SIZE I.D.

| | REPUBLIC RUBBER SPEC. | WIRE BRAIDS | HOSE O.D. | MAX. W.P. | MIN. BURST | APPROX. WT./100' | BEND RADIUS |
|---|---|---|---|---|---|---|---|
| 5/16" | W-18-31 | 2 | 3/4" | 4500 | 18,000 | 37 | 5" |

It's EASY to select WIRETEX! Simply move the slide until the needed I.D. size shows under the arrow or any known factors show on the selector. The Republic Rubber Spec. number will be the correct WIRETEX hose for you.
It's EASY, too, to get one of Republic's new WIRETEX Selectors. This handy little slide fits right in your pocket (or desk drawer) and will unfailingly select the right Republic WIRETEX Spec. to fit any known factor.
SEND FOR YOURS TODAY! Write to:

*"Quality Hose Builders for over 50 Years"*

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO
INDUSTRIAL RUBBER PRODUCTS

Circle 153 on Reader Service Card


## *Free Literature Offered in this Month's Ads*

Continued

AFTERCOOLER that swiftly removes oil and moisture from compressed air is described with complete specifications in a bulletin offered by The Heat-X-Changer Co., Inc.

Circle 88 on Reader Service Card

AIR CYLINDERS are covered in Catalog No. 103, "High Pressure Hydraulic Cylinders", prepared by The S-P Mfg. Corp.

Circle 165 on Reader Service Card

CYLINDERS for both hydraulic high pressure and air, and low pressure hydraulic, are described in bulletin 350 available by writing Hydro-Line Mfg. Co.

Circle 99 on Reader Service Card

TOGGLE VALVES are described in a catalog and data sheets prepared by Hoke, Inc. Several types are included.

Circle 90 on Reader Service Card

AIR CYLINDERS are discussed in Bulletins A-105 and H-104 offered by Miller Motor Company. Complete cylinder line is included, such as low and high pressure hydraulic cylinders.

Circle 120 on Reader Service Card

VALVE Bulletin No. 257 is available from Hanna Engineering Works. Complete with illustrations, the bulletins offer helpful information.

Circle 85 on Reader Service Card

ARIDIFIER traps dirt, oil, scale and water in gas or compressed air lines. How this is done is described in a catalog offered by Logan Engineering Co.

Circle 114 on Reader Service Card

OIL-LESS PUMPS are described in data sheet which shows a few types and rating tables. It can be obtained by writing Gast Mfg. Corp.

Circle 75 on Reader Service Card

SKINNER ELECTRIC VALVE DIV.
105 Edgewood Ave.
New Britain, Connecticut

## Please Help Us...

We would like complete data on the Skinner Valves checked below:

☐ V10 ☐ V61 ☐ V2 ☐ V5-2
☐ V5-3 ☐ V9 ☐ V50 ☐ M3
☐ M2 ☐ X5

☐ Send full information on valves for _____

Name _____
Company _____
Street _____
City _____ State _____
☐ Have salesman call (approx.) date _____

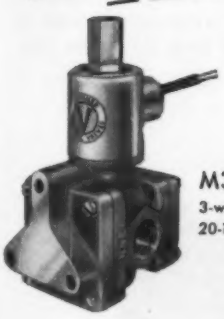
Attach to Company Letterhead

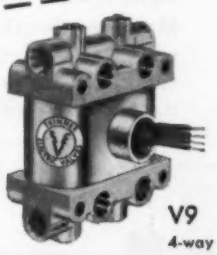
you will find the modern approach to your **SOLENOID VALVE** problems...

# SKINNER VALVES GUARANTEE MILLIONS of CYCLES

*(on most applications)*

The measure of performance in an electric valve is in *cycles*—millions of them in Skinner Valves... with the kind of guaranteed performance made possible through the constant research, lab testing and design facilities, know-how of Skinner engineers and the productive capacity of an ultra-modern plant. Skinner Solenoid Valves have a record of *satisfactory* and *dependable performance* in countless installations for gaseous or liquid control. Many models are Underwriters' Approved. Let us approach your problem in the modern manner. Some of the many Skinner Valves are shown below.


**M3**
3-way
20-150 p.s.i.

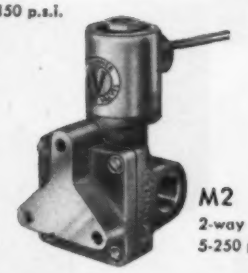

**V9**
4-way
0-150 p.s.i.

**V61**
2-way
0-300 p.s.i.

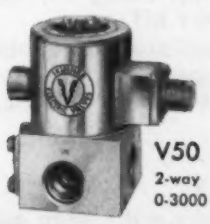
**V5-2**
2-way
0-1000 p.s.i.

**X5**
Same as V5 valves (except explosion proof)
0-300 p.s.i.

**V2**
2-way
0-200 p.s.i.


**M2**
2-way
5-250 p.s.i.

**V10**
3-way
0-1000 p.s.i.


**V50**
2-way
0-3000 p.s.i.

**V5-3**
3-way
0-300 p.s.i.

World's Largest Manufacturers of Stainless Steel Solenoid Valves

# SKINNER SOLENOID VALVES

**SKINNER ELECTRIC VALVE DIV., The Skinner Chuck Company, 105 Edgewood Ave., New Britain, Connecticut**

# BARKSDALE • MELETRON

## PRESSURE SWITCH • MODEL 9612

**PRESSURE RESPONSE CHARACTERISTICS**

Accurate sensing of any system pressure over an Adjustable Range of 15 to 3,000 P.S.I. This adjustment range is obtained through 4 Fitting Kits which are interchangeable on the same basic Body Kit. Will actuate an electric circuit at any predetermined point on increasing or decreasing pressure.

External adjustment screw for field setting.

The Fixed Actuation Value varies from 10 to 300 P.S.I. depending on switch setting.

Models designated—H are for Hydraulic Oil only.

Models designated—WA have stainless trim for use with Water, Air, and Gas.

## OPERATING CHARACTERISTICS • ORDERING DATA

| Proof Pressure | Adjustable Range Decreasing Min. | Adjustable Range Decreasing Max. | Adjustable Range Increasing Min. | Adjustable Range Increasing Max. | Actuation Value (Differential) Approx. | Service | Catalog Number |
|---|---|---|---|---|---|---|---|
| 3,000 | 15 | 175 | 25 | 200 | 10-25* | HYD. OIL | 9612-0-H |
| | | | | | | WATER, AIR, GAS** | 9612-0-WA |
| 3,000 | 35 | 350 | 40 | 400 | 15-50* | HYD. OIL | 9612-1-H |
| | | | | | | WATER, AIR, GAS** | 9612-1-WA |
| 7,000 | 125 | 1400 | 150 | 1500 | 20-150* | HYD. OIL | 9612-2-H |
| | | | | | | WATER, AIR, GAS** | 9612-2-WA |
| 7,000 | 250 | 2800 | 325 | 3000 | 35-300* | HYD. OIL | 9612-3-H |
| | | | | | | WATER, AIR, GAS** | 9612-3-WA |

Pressures in P.S.I.

* Fixed at any pressure setting, varies as shown from lowest to highest setting.

** Consult factory for CORROSIVE GAS SERVICE.

BODY KIT (complete switch less fitting kit) may be purchased separately — specify as 9612 BODY KIT.

FITTING KITS for all services and pressure ratings may be interchanged and purchased separately — specify as 9612-0-H FITTING KIT, 9612-0-WA FITTING KIT, 9612-1-H FITTING KIT, etc.

### DETAIL DATA

ELECTRICAL CHARACTERISTICS

Incorporates an U.L. approved s.p.d.t. snap action switching element rated for AC and DC circuits. Recommended to operate relays, solenoids, motor controls, and similar devices.

Automatically reset by snap action of switch.

Electrical connection is made through 13/16 hole for ½ inch conduit connector to screw terminals on switch.

PRESSURE CONNECTION: ¼ — 18 N.P.T. internal thread.

MOUNTING: Two 9/32 holes in mounting bracket.

WEIGHT: 2 pounds.

## FEATURING

**Long service life**

The piston type pressure sensing element can be expected to perform millions of cycles under fast, continuous operation, where flexing elements will fatigue or rupture.

**Not sensitive to surges or vibration**

Generous piston travel plus extremely high proof pressure, prevents the undesirable actuation or damage from line surges, jarring or vibration.

**Flexibility of application**

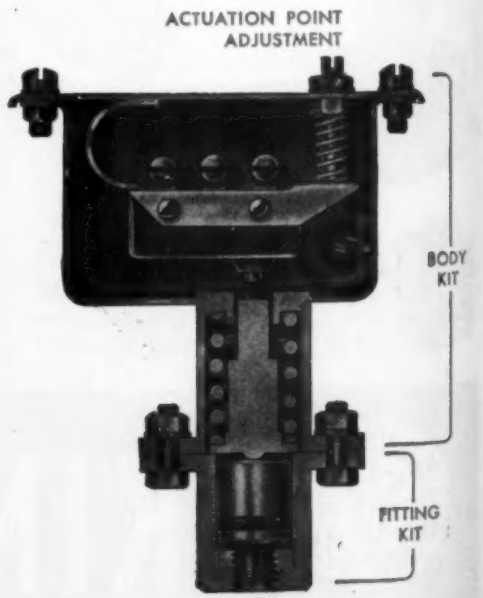
The same basic switch body may be converted to any of the operating characteristics tabulated at left, by simply changing fitting kits. The easily accessible electrical terminals may be arranged to open or close the circuit on increasing or decreasing pressure.

**Tamperproof adjustment**

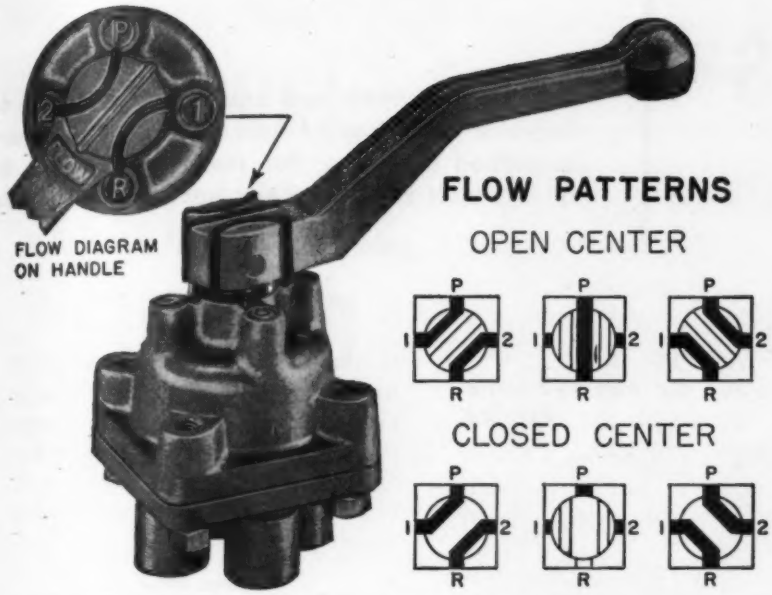
The switch setting is adjusted externally and locked in place to avoid its accidental disturbance.

**Pressed steel housing** protects switch against dust, damage, and moisture.

**Mounting bracket** is exceptionally adaptable, may be rotated to any position on a full circle, or moved up and down on the neck of the switch.



# MANUAL • 4-WAY SELECTOR VALVES • 1500 P.S.I.. OIL SERVICE




## FLOW PATTERNS

OPEN CENTER




CLOSED CENTER




| ORDERING DATA | | | VALVE CHARACTERISTICS | | | |
|---|---|---|---|---|---|---|
| Port Size | Valve Number | | Minimum Flow Passage | Rated Flow at 20 ft. per sec. velocity* | Handle Load (at end of handle) at Rated Pressure | Shipping Weight (approx.) |
| | Open Center | Closed Center | | | | |
| ¼" N.P.T. | C-121-S1-HO3 | C-121-S1-HC3 | ¼ DIA. | 3 G.P.M. | 10 LBS. | 3 LBS. |
| ⅜" N.P.T. | C-122-S1-HO3 | C-122-S1-HC3 | 7/16 DIA. | 9.5 G.P.M. | 20 LBS. | 5 LBS. |
| ½" N.P.T. | C-123-S1-HO3 | C-123-S1-HC3 | 7/16 DIA. | 9.5 G.P.M. | 20 LBS. | 5 LBS. |
| ¾" N.P.T. | C-124-S1-HO3 | C-124-S1-HC3 | ¾ DIA. | 27.5 G.P.M. | 30 LBS. | 17 LBS. |
| 1" N.P.T. | C-125-S1-HO3 | C-125-S1-HC3 | ¾ DIA. | 27.5 G.P.M. | 30 LBS. | 17 LBS. |

* Valves are capable of withstanding velocities up to 60 ft. per second without modification.

## FEATURING

**The patented "Shear-Seal" principle** and its unique advantages: Leak-proof closure, low handle load, high flow capacity, no "wire-drawing," not critical to dirt, only one moving valve member, excellent throttling, no "freeze-ups," simple and rugged design that pays off in long trouble free service life. Valving members wear-in where others wear-out!

Plus:

Flow diagram incorporated on handle indicates flow for all actuating positions.

Fully enclosed position stops and detents.

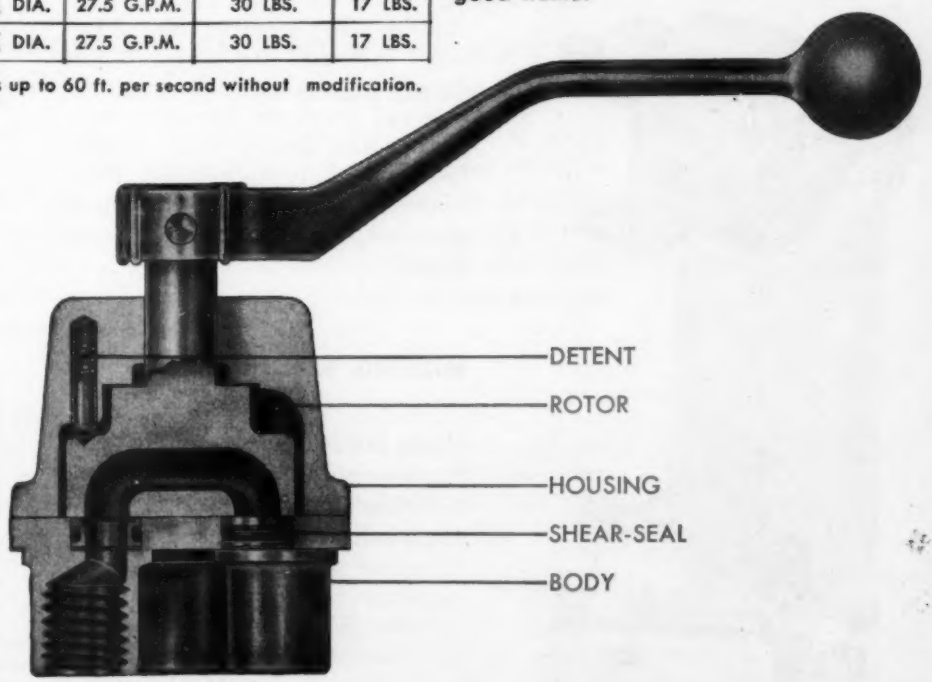
**Extreme versatility** for the Original Equipment Manufacturer: Straight porting readily provides for manifolding, by using standard nipple and tee in pressure and return ports and street ells in cylinder ports (see installation hints on reverse side).

"Pedestal", bracket, or panel mounting.

Spring centering and positive locking device available as standard accessories.

Designed for mass application and mass production.

**Low initial cost** to keep the Original Equipment Manufacturer in a competitive position, and **low maintenance** to protect his good name.




**ACCESSORIES** (at extra cost)
**SPRING CENTERING** devices are available for ¼, ⅜, and ½ inch 4-way valves.
**POSITION LOCK** may be furnished for all valve sizes, where accidental movement of valve handle must be prevented. Snap action locked position can be changed only by intentionally pressing the release lever.

Write for specific catalogs on other Barksdale controls:
Pressure Switches for all pressures and functions, Catalog 3M-1.
Manual 'Shear-Seal' Valves, Shut-Off and Selector, to 6000 P.S.I., Water, Oil, and Air Service, Catalog 4B-1.
Solenoid 3-Way and 4-Way Air Valves to 500 P.S.I., Catalog 3C-1.
Solenoid 'Shear-Seal' Valves, Shut-Off and Selector, for Water, Oil, and Air Service, Pressures to 3000 P.S.I., Catalog 1B-2.

# BARKSDALE VALVES

5125 ALCOA AVENUE, LOS ANGELES 58, CALIFORNIA

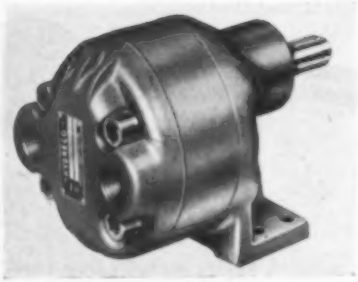
# NEW PRODUCTS

**Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.**

### *NEEDLE VALVES*
***. . . for air and hydraulic service***

**Designation:** 270 Series
**Sizes:** ⅛ to ½ in. NPT. Both straight line and angle pattern are available.
**Design:** Choice of "O" ring seal or conventional packing. Made of brass or 430F stainless steel bar stock. "O" ring style is particularly suitable for test panel high pressure air or hydraulic service. No packing adjustment is required. Has a self-aligning spindle that insures tight seating. Design permits repacking under pressure.

**Hoke, Inc.,**
**Englewood, New Jersey**
Circle 230 on Reader Service Card

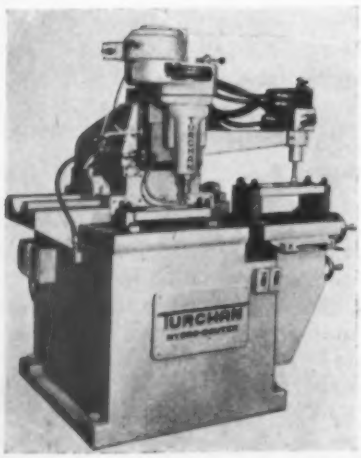


### *FLUID MOTORS*
***. . . gear units to 52 hp***

**Design:** Hydreco four-bolt design gives the motor rigidity and stability by locating the four bolts (all that are required for assembly) in the area of greatest internal pressure. Bronze wearplates and heavy duty roller bearings add to ruggedness. Furnished with flange or foot mounting and straight or splined shaft.

**Sizes:** Fluid motors in capacities up to 52 hp and for operating pressures up to 1500 psi.
**Features:** Fluid motors for application on machine tools as well as on mobile equipment. Motor is gear type and offers reversible rotation. Starting torque is exceptionally high.

**Hydreco Division**
**The New York Air Brake Company,**
**Cleveland, Ohio**
Circle 231 on Reader Service Card




### *MILLING MACHINE*
***. . . with tracer control***

**Designation:** There are several models, pictured is the smallest of the line, Model 1-24.
**Hydraulic Operations:** Hydraulic tracer servo-control provides accurate positioning of vertical spindle slide, ram and ram slide, whereby the tool reproduces the same form as dictated by stylus in contact with master. All hydraulic feeds are of infinitely variable feed rates with stepless automatic tracer control.
**Features:** Table working surface is 32½ x 14½ in, longitudinal range 24 in, cross 12 in, vertical 8 in. All feed rates are infinitely adjustable, 0-65 in/min. Spindle speeds range from 900 to 3600 rpm. Floor space 76½ x 47½ in. approximate weight is 4300 lbs. Standard equipment includes: three dimensional tracer-control; coolant tank with pump, motor and piping; splash and chip guard; cutter adapter draw bar; hydraulic power unit; and complete motor controls.

**Turchan Follower Machine Company**
**Detroit, Mich.**
Circle 232 on Reader Service Card

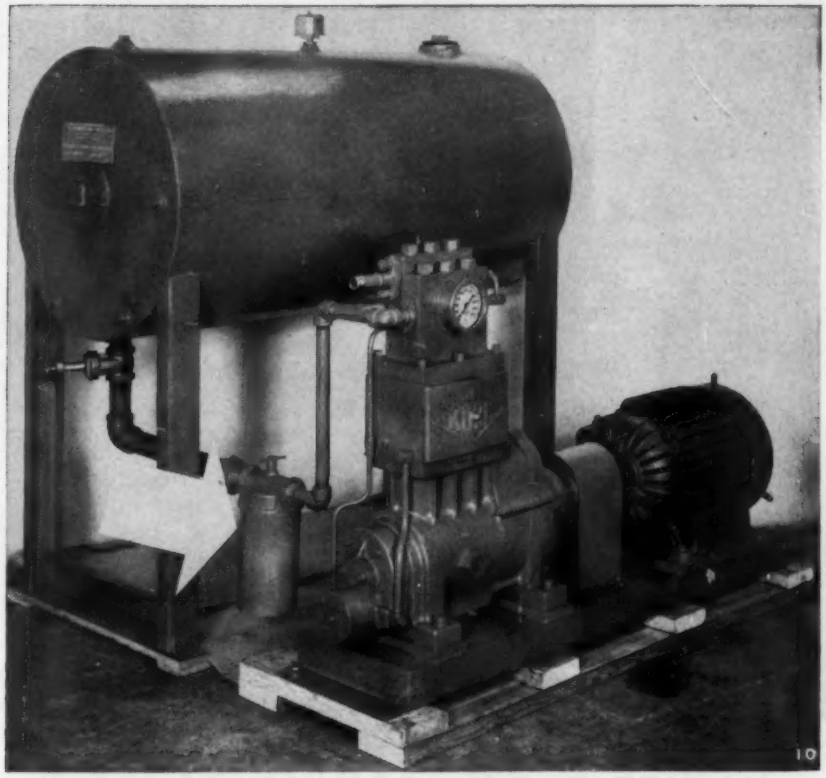
*For more New Product Information turn to page* 172

# To Insure Continuous Efficient Operation

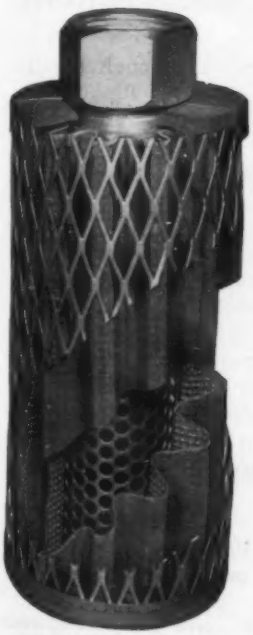
# MARVEL SYNCLINAL FILTERS

## Are Installed AS

# STANDARD EQUIPMENT



Hydraulic Power Unit Model 150-HPT-17. Showing installation (indicated by arrow) of a line type Marvel Synclinal Filter.
Photo Courtesy Weinman Pump & Supply Co., Pittsburgh, Pa.



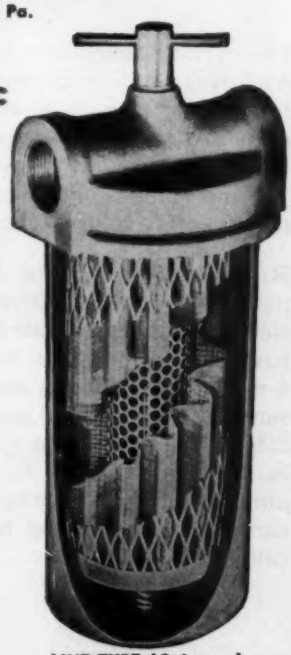
SUMP TYPE (Cutaway)

## For Dependable Protection On All Hydraulic And Low Pressure Circulating Systems

Weinman Pump and Supply Co., advises that: The installation of Marvel Synclinal Filters as standard equipment has proven they are most efficient in filtering out all foreign material and protecting their units. This assures the users of this equipment, long periods of continuous operation before filter maintenance is necessary. The decision for installing Marvel Synclinal Filters as standard equipment was the result of thorough and rigid tests conducted by their Engineering Department.

## A SIZE FOR EVERY NEED

Marvel Synclinal Filters are available in sump and line types, in capacities from 5 to 100 g.p.m. and in monel mesh sizes from 30 to 200. Line types operate in any position and may be serviced without disturbing pipe connections.



LINE TYPE (Cutaway)

**WATER FILTERS** — In response to the great demand, we have adapted both our sump and line types for use in all water filtering applications. No changes have been made in the basic synclinal design.

**MARVEL** *Engineering Company*

625 WEST JACKSON BLVD., CHICAGO 6, ILLINOIS

Marvel Engineering Company
625 W. Jackson Blvd.
Chicago 6, Illinois

AH-10

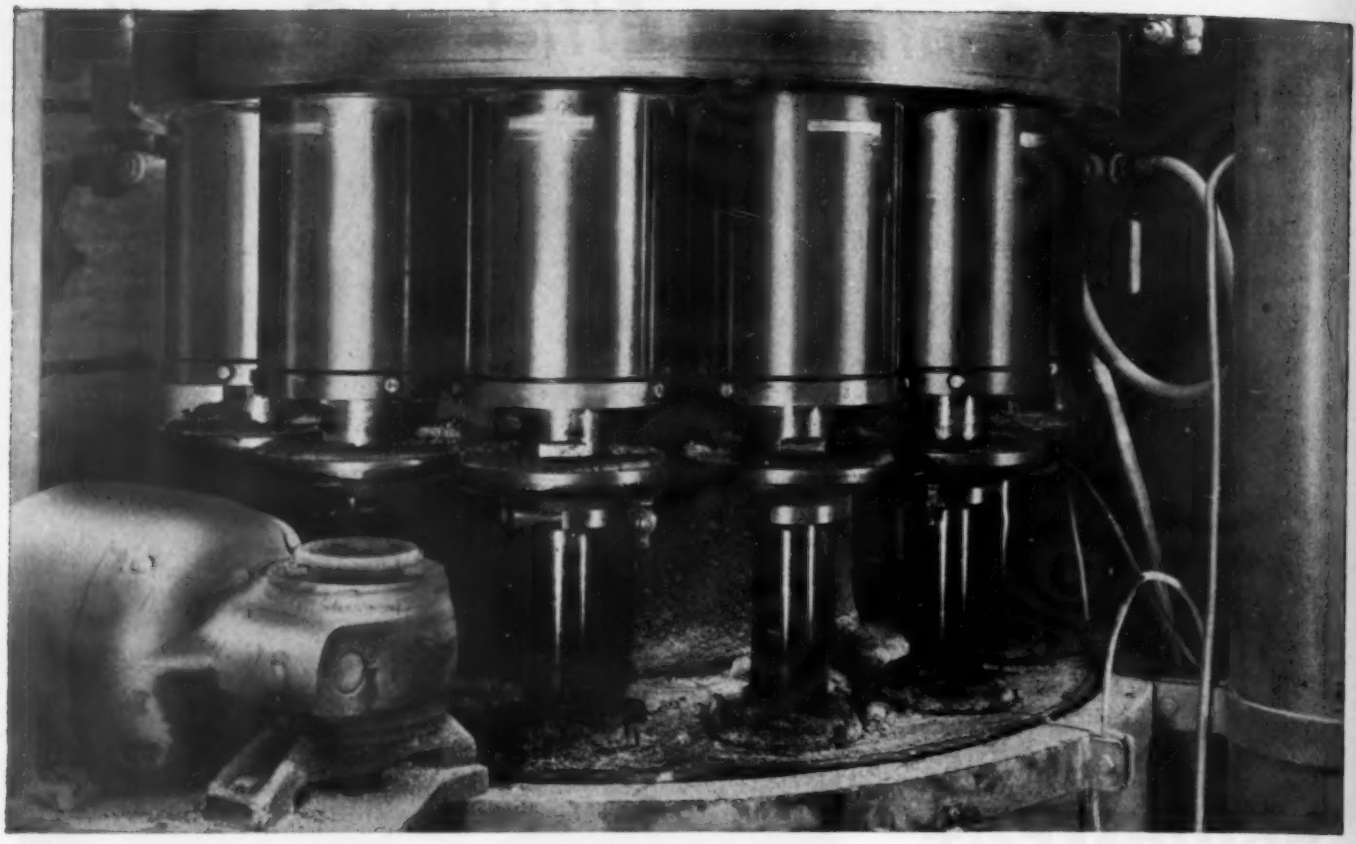
Without obligation, please send me your Catalog #106 containing complete engineering data on Marvel Synclinal Filters.

Name .....

Company .....

Address .....

City ..... Zone ..... State .....



# R/M VEE-FLEX® PACKING RINGS handle a tough assignment

The packing assignment was explicit. *No leakage must be allowed to by-pass the packing rings, spill over the machine and run into the molds.* Rejections and shutdowns would result. The machine—an automatic molding machine—is pictured above.

R/M Vee-Flex Packing Rings were put on the job last November. Ever since the installation date the machine has been operating 24 hours a day, 6 days a week under a constant pressure of 1000 psi, and at approximately 200°F. *The original packings are still in use.* Leakage is so slight that the atmospheric dust absorbs it before it can spill over into the molds; so it causes no shutdowns.

To understand why, take a look at this cut-away view of a nest of R/M Vee-Flex Packing Rings. Note how the surface of each ring is convexly curved where it touches the next ring. When the hydraulic pressure stroke occurs, this construction produces an automatic seal laterally against the stuffing box wall and longitudinally against the next ring. Photoelastic analyses,* corroborated by radial pressure tests,* prove that maximum sealing performance occurs at a point slightly below mid-width.

If you are packing pumps, valves, rams, presses, cylinders, accumulators or other hydraulic equipment, R/M has Vee-Flex Rings to meet your most exacting requirements—five different types, for example, seal against pressures ranging to 6000 psi and more. Different types are available for air, gas, steam, oil, water, food products, etc.

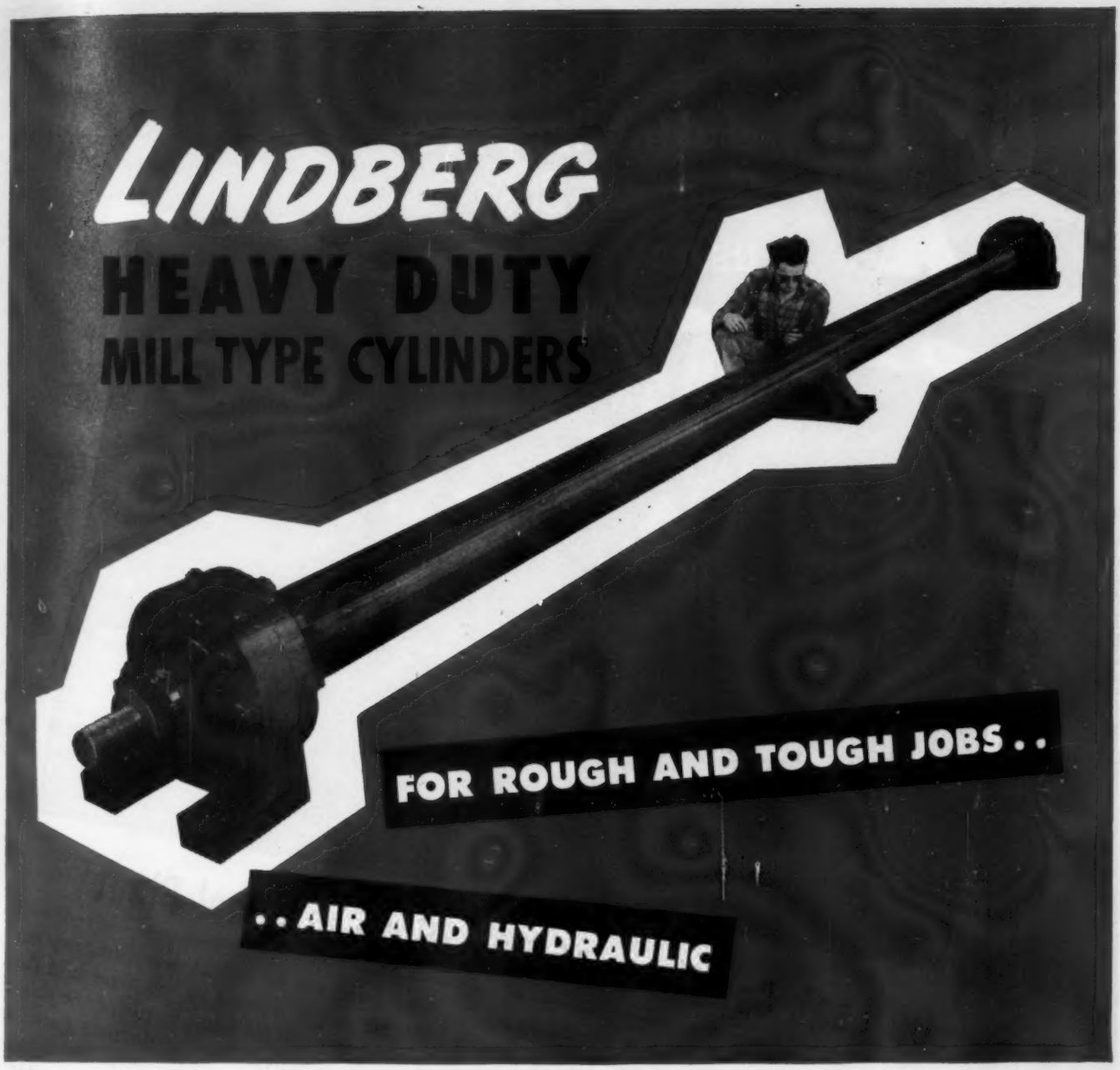
***Write for R/M Vee-Flex Bulletin giving complete data and table of sizes.***

**Performed at the Franklin Institute Laboratories for Research and Development*

**R/M PACKINGS**
**RAYBESTOS-MANHATTAN, INC.**
**PACKING DIVISION, MANHEIM, PA.**

**FACTORIES:** Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Crawfordsville, Ind.; Passaic, N.J.; Neenah, Wis.; Peterborough, Ontario.

RAYBESTOS-MANHATTAN, INC., Manufacturers of Packings • Teflon Products • Asbestos Textiles • Industrial Rubber Products • Abrasive and Diamond Wheels Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Fan Belts • Radiator Hose • Sintered Metal Products • Bowling Balls




Lindberg Mill Type Cylinders are heavy, tough cylinders . . with plenty of guts built in. They'll handle the meanest and most demanding job you can think of, and they're not just fair weather cylinders . . they'll perform dependably under the most adverse operating conditions.

In short, Lindberg Mill Type air or hydraulic cylinders can take on any big, rough and tough application you have.

*Lindberg also builds a standard catalog line of heavy duty air and hydraulic cylinders . . up to 12". Ask for bulletin #731 on air cylinders . . #701 on hydraulic cylinders.*

AIR . . HYDRAULIC

# LINDBERG CYLINDERS

**Lindberg Engineering Company, 2441 West Hubbard Street, Chicago 12, Illinois**

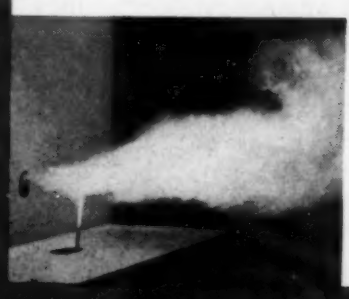
# Losses Like this couldn't happen to Houghto-Safe users

## Oil Leak Causes $100,000 Blaze in Local Plant

Fire caused by an oil leak destroyed most of the Holmesburg Manufacturing Company's plant last night in a blaze causing damage estimated at over $100,000. Flames raged for seven hours before firemen from five municipal fire companies had the fire under control. T... were ... was overcome by smoke and company employees nearly trapped by the blaze said they groped through the plant to escape the smoke that was rapidly filling the doomed building. One of the workers was rendered unconscious and had to be carried out by firemen. He is Henry F. Marburger, o... f several men in the ...

## 5 years in the Lab —now proved in the field!

### CONVENTIONAL OIL BURNS INSTANTLY



An atomized jet of regular hydraulic oil pressure-sprayed into flame from a blow torch ignited immediately into an 8-foot blaze

# New Hydraulic Fluid Won't Burn or Explode!

## Houghton

# HOUGHTO-SAFE

## IS SAFE 7 WAYS!

**Perfected after more than five years of research and field testing, Houghto-Safe offers protection to both men and machines. This new hydraulic fluid . . . rated "acceptable from the fire hazard standpoint" by Factory Mutual . . . now proves that fire-resistant qualities *can be obtained without loss in operating efficiency!* In plants performing die casting, welding, hot press forging and other hydraulic operations—especially near open flames or extreme heat—Houghto-Safe is the long-awaited answer. Here are 7 good reasons why it's really safe . . .**

1. **It's Non-Flammable**—This newly-developed hydraulic fluid won't burn or flash—even when sprayed into an open flame.
2. **Prevents Corrosion**—The new formula contains inhibitors developed by Houghton to prevent corrosion and rust in any hydraulic system.
3. **It is Non-Toxic**—Safe for workers to handle—and it bears no unpleasant odor.
4. **Fortified Lubricity Saves Equipment**—Reinforced for high film strength by a chemical additive that gives metal parts greater protection for longer periods.
5. **Oxidation Stability Adds Extra Life**—Its exceptional resistance to oxidation assures longer service life—proved by over 5500 hours of testing in equipment in actual use.
6. **High Viscosity Index Reduces Wear**—New Houghto-Safe has a viscosity index of 150, showing its stability through widely fluctuating temperatures, and providing safe operation at all normal temperatures. It won't freeze—pumps easily at zero without preheating.
7. **Safe for Packings**—Has no ill effect on synthetic rubber packings—neither attacks them nor impairs their high efficiency throughout their effective life.

HOUGHTO-SAFE WOULDN'T IGNITE!

This non-flammable fluid, similarly sprayed under pressure into the same flame, would not ignite—no flash, no flame

HOUGHTO-SAFE

**. . . a product of**

**Ask the Houghton Man for our new bulletin, containing research data, case histories and pictured proof of Houghto-Safe's efficiency. Or write to E. F. Houghton & Co., Philadelphia 33, Pa., for answers to any questions you may have about this new safe hydraulic fluid.**

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

**Ready to give you on-the-job service . . .**



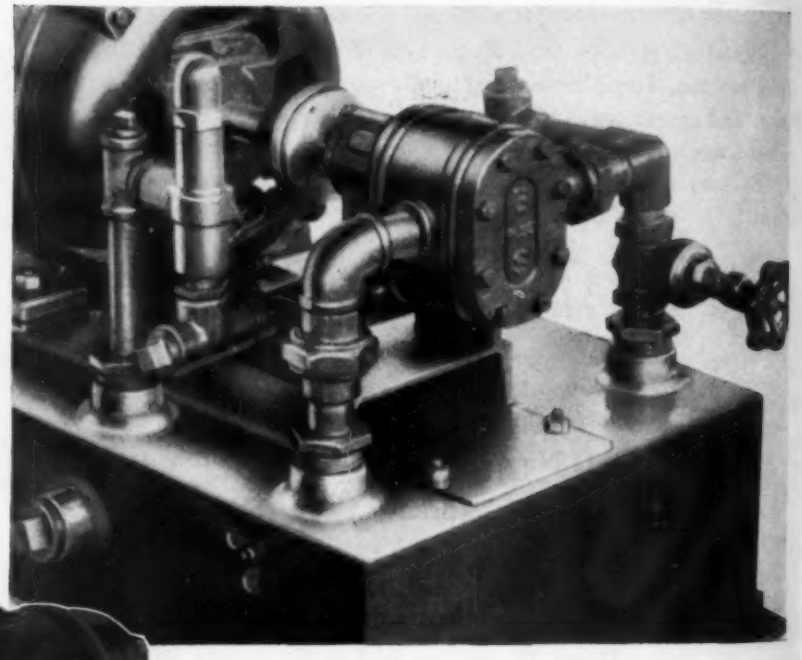
Circle 91 on Reader Service Card

# POINT WITH PRIDE . . .

## to the pump on your hydraulically-operated product

***Brown & Sharpe No. 53 or 55***
***Rotary Geared Pump***
***with Helical Gears and Antifriction Bearings***

You can point with pride to a quiet operating pump that gives smooth flow and long service when you equip your machines with Brown & Sharpe Rotary Geared Pumps. Made with helical gears of extreme accuracy and operating on antifriction bearings, these pumps efficiently deliver large volumes of oil at high speeds and under pressures up to 200 psi. The No. 53 supplies up to 23 gpm. and the No. 55 supplies up to 34 gpm. They may be direct, gear, or pulley driven. An excellent mechanical seal eliminates all leakage worries.



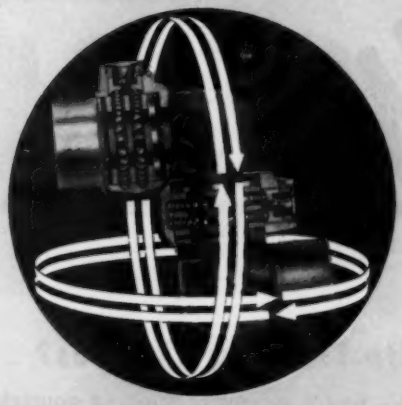
These are but two of the 185 stock pumps that you will find in the Brown & Sharpe Pump Catalog. Write for your copy . . . it gives detailed data on a complete line for hydraulic applications. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

***BUY THROUGH YOUR LOCAL DISTRIBUTOR***

# Brown & Sharpe

B·S

# CHIKSAN



## THE NEW TOOL OF ORIGINAL EQUIPMENT MANUFACTURERS

Now Modern Industry has a *New* Tool available in CHIKSAN Ball Bearing Swivel Joints. These revolutionary flexible joints turn with full 360° rotation in 1, 2, and 3 planes, handling air, hydraulics, fuels, oils, water and other fluids.

There are over 1,000 different types, styles and sizes for pressures and services from 28" vacuum to 15,000 psi and for temperature ranges from minus 75° F. to a plus 500° F. Packing materials have been designed for each specific service.

Wherever unlimited flexibility is required in your research, design and engineering of new equipment for modern industry—CHIKSAN will help you find the solution.

**Write for Catalog 53-C. Dept. AH-10.**

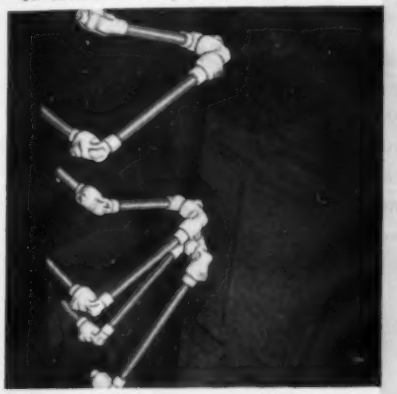
*The Flow of Enterprise Relies on*

# CHIKSAN

*Ball-Bearing Swivel Joints*

CHIKSAN TRADE MARK REG.

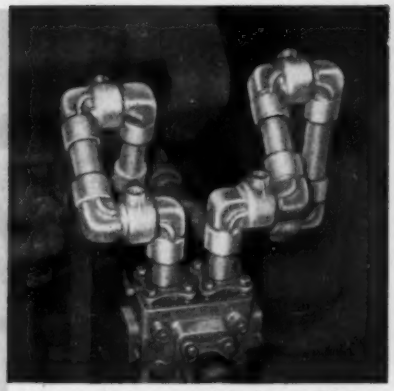
Chiksan swivel joints in landing gear, braking and hydraulic control systems on Lockheed's Super-Constellation.



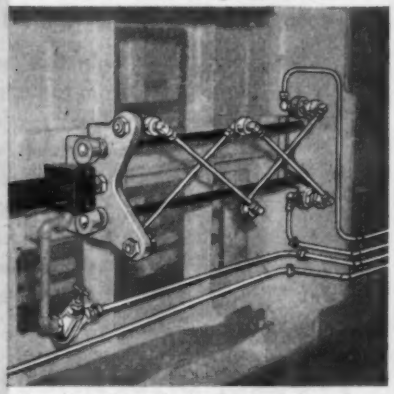
Chiksan high-pressure swivel joints provide complete flexibility and safety in steam lines on platen presses.

Most hose reel manufacturers employ Chiksan swivels for pressure and vacuum tight connections with low torque.

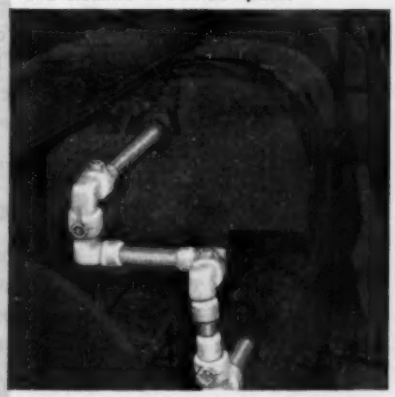
Colorado School of Mines turned to Chiksan swivel joints for air and hydraulic lines on shale mining equipment.



Johnson Motors cut fluid losses 75%—setting-up time 75% with Chiksan joints on their 48 die-casting machines.



Ermold automatic bottle unpacker uses Chiksan hydraulic joints for flexibility and stamina in limited space.



Chiksan high-pressure swivel joints are installed for dependability and safety in injection molding equipment.

Chiksan swivel joints are used on the coolant lines on the 160" plate mill in U. S. Steel's Homestead Works.

**CHIKSAN COMPANY** • BREA, CALIFORNIA • Chicago 28, Illinois • Newark 2, New Jersey

Well Equipment Mfg. Corp. (Division), Houston 1, Texas • Chiksan Export Company (Subsidiary), Brea, California • Newark 2, N. J.

APPLIED HYDRAULICS

# Trends IN THE FLUID POWER FIELD

## Where Are We Going With Training Courses?

In this issue you'll find a survey of training courses in hydraulics and pneumatics offered in industry and by engineering schools. As far as we know, no engineering school offered courses in Industrial Hydraulics five years ago. Fluid mechanics and civil engineering hydraulics were all that was known. Today several schools have offered elective courses in oil hydraulic circuits. Many college department heads, answering our request for information, expressed interest in what other schools were offering and indicated a growing trend to add Industrial Hydraulics courses. The more important need is for extension and evening courses which men in industry can attend. Several such courses are now being offered; many more are needed.

## Product Diversification and the Fluid Power Market

Will diversification be an economic hedge? A number of large companies apparently think so. Mergers between companies are being announced regularly and new lines are being added to broaden the sales bases. Integration among companies making hydraulic components has strengthened and broadened their lines. Other manufacturers have entered the hydraulic and pneumatic field to further diversify their products and to aim for a maintenance and replacement business.

## Hydraulics in the Mobile Equipment Field

The gains which hydraulic components have made in the mobile equipment field in the past years have been little short of phenomenal. Major gains have been made in the agricultural equipment, excavating and earthmoving equipment and in industrial trucks. According to the Bureau of the Census, Department of Commerce, the value of products shipped in agricultural equipment, except tractors, and in tractors only have each grown to well over a billion dollars a year. The same source indicates that close to a billion dollars worth of excavating and earthmoving equipment was shipped in 1952. The industrial truck group passed the $300,000,000 rate in 1952. With the decline in the production and sale of agricultural equipment, a "soft spot" has developed in the sale of hydraulic components—particularly pumps, tube, hose and fittings—to this market. Indications are that the decline will not be proportional since a higher percentage of hydraulically actuated implements and accessories will be represented. The value of shipments of excavating and construction equipment continued steadily upward through 1952. Recent estimates are that a slight decrease in volume may be expected by mid-1954. The sale of industrial trucks is still growing and can be expected to increase this year over last and to continue on a high level. On the basis of manufacturers' estimates, the sale of hydraulic equipment to these sections of the mobile equipment field (the tremendous automobile, truck and bus fields have not been included) should continue on a sound, high level.

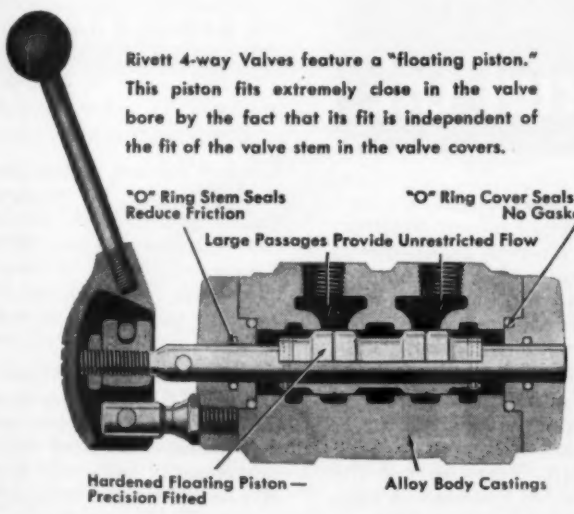
## More Sources for Gear Type Fluid Motors

Not long ago fluid motors using gears were considered impractical. They couldn't overcome their own losses let alone develop any usable power. Manufacturers of gear pumps have now gathered sufficient experience and production know-how to reduce friction losses and bearing loads to the point where gear motors are practical. At least three American manufacturers offer a line of gear motors which will develop up to 50 hp at 1500 psi.

# HYDRAULIC VALVES—

# 138 MODELS FOR EVERY NEED!

offered in 1500 P.S.I.—3000 P.S.I. for most models
Five piston designs to meet the requirements of any circuit
Six types of operation —hand, foot, cam, solenoid, oil pressure, air pressure
Four types of action —standard, spring return, spring centered, ball detent
Seven sizes available —¼", ⅜", ½", ¾", 1", 1¼", 1½"


Rivett 4-way Valves feature a "floating piston." This piston fits extremely close in the valve bore by the fact that its fit is independent of the fit of the valve stem in the valve covers.
"O" Ring Stem Seals Reduce Friction
"O" Ring Cover Seals— No Gaskets
Large Passages Provide Unrestricted Flow
Hardened Floating Piston— Precision Fitted
Alloy Body Castings

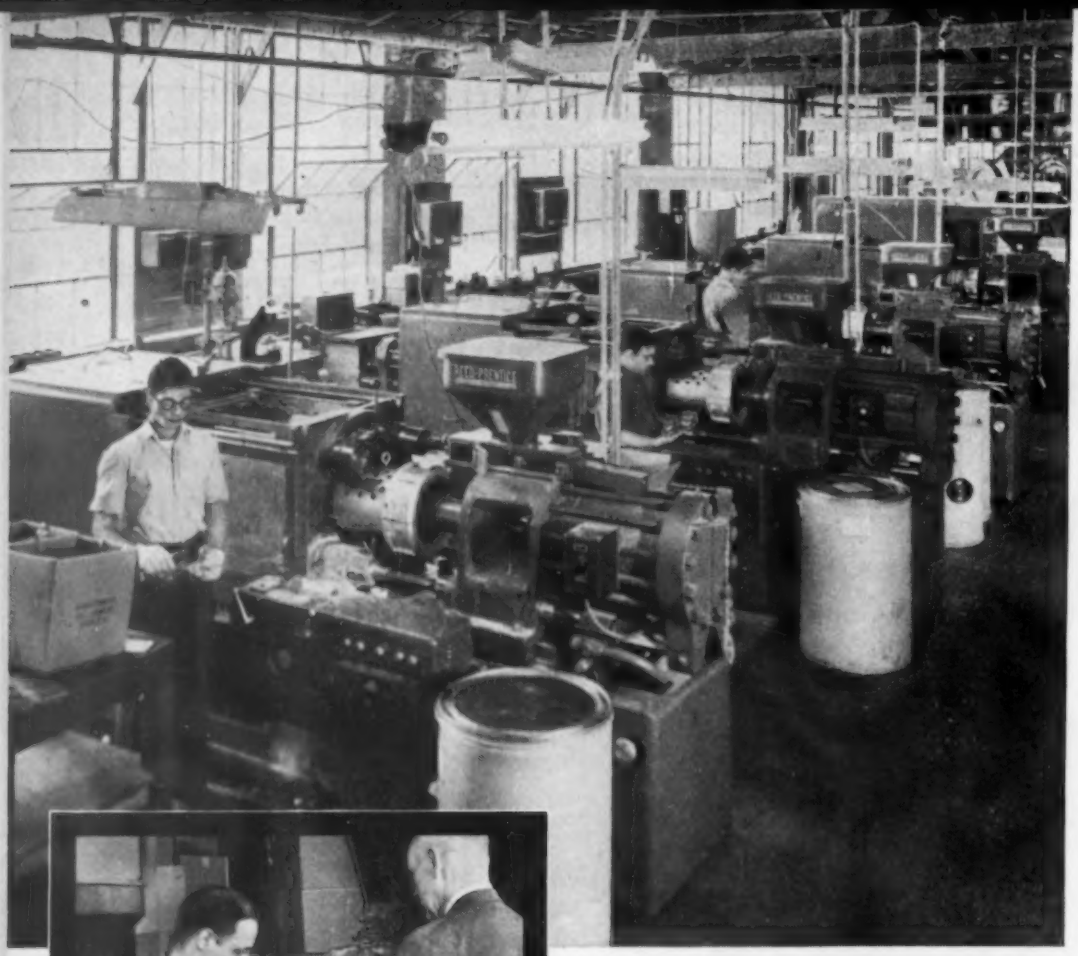
You can plan a more efficient hydraulic circuit by choosing from the wide selection of Rivett valves. Every type of control is available, both direct and remote, including sequence, shut-off, check, relief, unloading, flow control and pilot. Not only does this Rivett variety assure you of a better operating system, but it also offers far greater latitude in design.

With Rivett you get the help of experienced distributors, who will assist in laying out the circuit best suited to your operating requirements.

**RIVETT LATHE & GRINDER, Inc.**
DEPT. AH-10 BRIGHTON 35, BOSTON, MASSACHUSETTS

**RIVETT furnishes a complete power package**

**VALVES • CYLINDERS • POWER UNITS**
Air and Hydraulic
All sizes and types



Despite cleanliness and efficiency of a midwest firm's Plastic Division, shown above, there was "dirty work" afoot in the hydraulic systems of the injection molding machines. Division superintendent (left) and A. L. Seabaugh, of Standard Oil, came up with a solution.

# Stops "dirty work" in hydraulic units

**STANOIL**
TRADE MARK
**Industrial Oil**

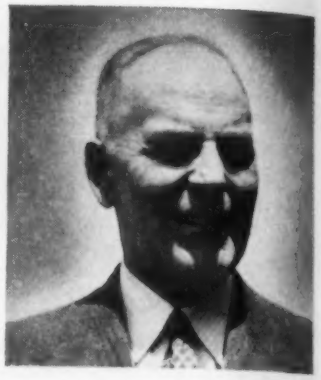
● A midwest company became increasingly aware that hydraulic oil performance in its fourteen injection molding machines was not all that it should be. Formation of oil deposits not only made frequent cleaning of filters necessary but posed a threat to efficient operation of the hydraulic units.

A Standard Oil lubrication specialist recommended STANOIL Industrial Oil, a top quality product of exceptionally high stability and containing necessary additives to prevent corrosion and oxidation troubles.

Throughout six years of continuous hard use, STANOIL has provided clean operation. It has not been necessary to replace any of the original fills of STANOIL, and only a small amount of make-up oil has been needed. Where filters previously had to be cleaned at least four times a year, they are now cleaned once each year. Hydraulic operation has been efficient and reliable.

You can rely on STANOIL to give you the same clean, dependable service not only in hydraulic units but in a wide variety of equipment. You can get the help of the Standard Oil lubrication specialist serving your section of the Midwest by phoning your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

# What's YOUR problem?



**A. L. Seabaugh,** working out of Standard's Chicago office, is the lubrication specialist who helped this midwest firm gain both operating and maintenance benefits through use of STANOIL in hydraulic units.

Located throughout the Midwest is a corps of specially trained, experienced Standard Oil lubrication specialists, ready to give you prompt, on-the-spot help with lubrication in your plant. Their broad background of practical experience, plus their thorough training in Standard Oil Lubrication Engineering Schools, is yours for the asking. Simply phone your nearest Standard Oil Company office. The lubrication specialist will call without delay. He has a complete line of petroleum products to offer, including such outstanding lubricants as:

**SUPERLA Greases** — Available in a wide range of consistency grades and in both lime-soap and soda-soap types. SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

**STANOLITH Greases** — Because these unique lithium soap products possess the heat resistant properties of soda-soap greases and the water resistant properties of lime-soap greases, they offer a solution to lubrication problems caused by the presence of both heat and water.

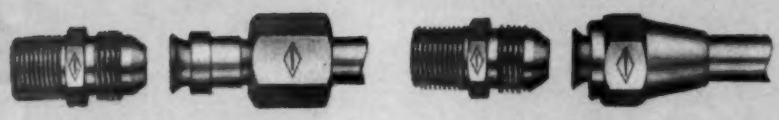
**STANDARD OIL COMPANY**

**STANDARD** (Indiana)

# *Everything you need . . .*

## for HYDRAULIC TUBING CONNECTION WORK

## IMPERIAL 37° *Steel* FLARED TUBE FITTINGS



**3-PIECE TYPE** has sleeve which reduces wrench torque required in tightening. Permits bends close to joint.

**2-PIECE TYPE** can be used for same applications as 3-piece type —offers advantages in economy.

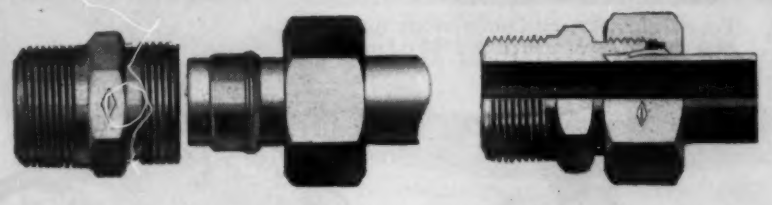
★ 2-Piece and 3-Piece Types. Withstand high pressure service and severe operating conditions.

★ Joints stay fluid-tight beyond burst pressure of the tubing. Meet J.I.C. requirements.

★ Used with J.I.C. and other soft steel tubing. Also copper, fully annealed stainless steel tubing, etc.

## IMPERIAL *Steel* ERMETO TUBE FITTINGS

### NO FLARING . . . NO THREADING . . . NO WELDING . . . NO SOLDERING



Fitting consists of 3 pieces: body, nut and sleeve.

When assembled, sleeve bites into tubing assuring a tight joint.

★ Make safe connections that withstand high pressures and vibration. Joints stay fluid-tight beyond burst pressure of the tubing itself. Meet J.I.C. requirements.

★ Easier and faster to install. Only an open wrench needed.

★ Can be used with practically any tubing, including heavy wall tubing that is difficult to flare.

## IMPERIAL TOOLS . . . *do jobs better—faster*

***HI-DUTY TUBE CUTTER.*** Has ball bearing action, flare cut-off groove in rollers. Retractable reamer. **No. 274-F** for 1/8" to 1" O.D. Tubing. **No. 312-F** for 1/4" to 1-3/8" O.D. **No. 206-F** for 3/4" to 2-1/4" O.D. Also **No. 384-F** Sawing Vise for tubing 3/16" to 1-1/2" O.D.

***37° FLARING TOOLS*** for SAE 1010 soft steel and other metal tubing. Make flares to J.I.C. standards. Easy, single lever clamping. One compact tool, **No. 437-F,** flares six sizes — 3/16", 1/4", 5/16", 3/8", 1/2", 5/8" O.D. Tubing. **No. 537-F** flares 3/4", 7/8", 1", 1-1/4" O.D. Tubing.

***UNIVERSAL GEAR-TYPE BENDERS.*** Will bend any type of tubing, including hard temper, heavy wall steel. Also pipe. High gear ratio makes bending easier. **No. 270-F.** Individual Benders for each size of tubing — 3/8", 1/2", 5/8", 3/4", 7/8", 1", 1-1/8" O.D. Also lever-type benders.

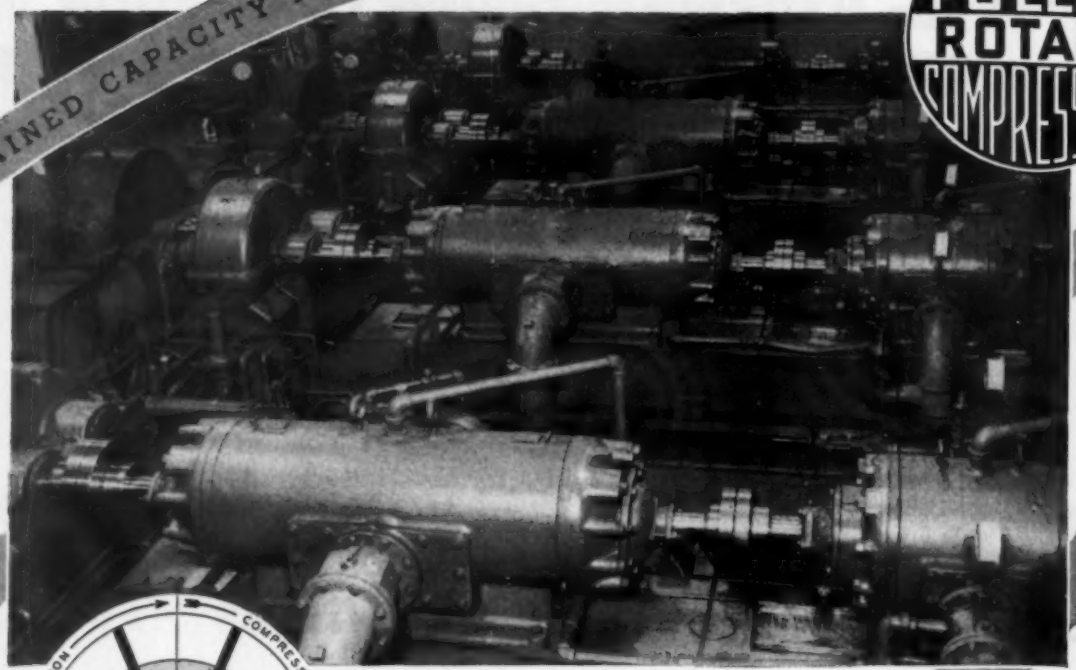
**THE IMPERIAL BRASS MFG. CO.,**
**1242 W. Harrison Street, Chicago 7, Ill.**

# IMPERIAL

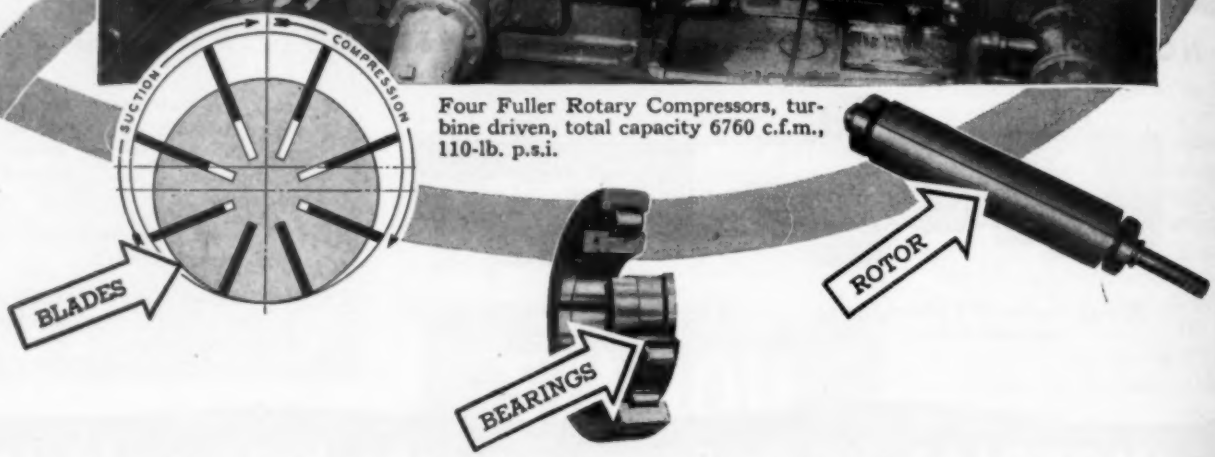
Pioneers in Tube Fittings and Tubing Tools

MAINTAINED CAPACITY FOR THE LIFE OF THE MACHINE

FULLER ROTARY COMPRESSORS



Four Fuller Rotary Compressors, turbine driven, total capacity 6760 c.f.m., 110-lb. p.s.i.



Due to design and construction, the blades of a Fuller Rotary Compressor automatically compensate for wear, thus eliminating loss of capacity. *Maintained capacity* is just one of the many outstanding features of the Fuller Rotary.

The fewer moving parts that make up any piece of equipment, the more continuous service at the lowest operating cost. Fuller Rotary Compressors are an outstanding example of simplicity . . . few moving parts—rotor, bearings, blades.

There is no adjustment of valves, no grinding of seats, no bearing take-up . . . moving parts are reduced to the minimum, all of which means fewer shut-downs, with less costly maintenance charges. Shut-downs are costly . . . lost time can never be recovered. Install Fuller Rotaries for day in and day out, continuous service.

Fullers are built for capacities to 3300 c.f.m. actual free-air delivery, 125-lb. pressure. Write for Bulletin C-6, illustrating and describing the design and construction of this modern compressor.

FULLER COMPANY, Catasauqua, Pa.
120 So. LaSalle St.—Chicago 3
420 Chancery Bldg.—San Francisco 4

# Fuller

C-229

PIONEERS OF HIGH-EFFICIENCY VANE-TYPE ROTARY COMPRESSORS

# DEECO

## INDUSTRIAL FITTINGS FOR HYDRAULIC EQUIPMENT

### Features of the Deeco Three-Piece Flare-Type Fittings

**Flare Angle:** 37° flare angle.

**Sleeve:** Sleeve expands during fitting assembly and acts as lockwasher—prevents nut from loosening under vibration and pressure impulses.

Sleeve remains stationary during assembly of nut on fitting, preventing wiping action on back of flare. Wiping of flare tends to work harden tubing at critical point behind tube flare, creating premature fatigue to tubing, particularly under vibrating conditions.

Sleeve remaining stationary also prevents twisting of tube when nut is assembled to fitting. Twisting of tube puts unnecessary stress on tube. Sleeve dampens vibration, protecting flare. Sleeve re-enforces flare.

Sleeve compensates for misalignment of tube to fitting. Automatically aligns flare to fitting nose.

**Burst Pressure:** Deeco Fittings remain fluid-tight far beyond tubing burst pressures.

**Low Assembly Torque:** One to two complete revolutions of nut with small wrench, after assembled finger tight, sufficient to develop fluid tight seal. This is most desirable when working in close quarters.

**Repeated Assembly:** Body, nut and sleeve may be re-used indefinitely.

**Close Bends:** Close bends to fitting assembly possible since there is adequate diameter to the tube nut to slip over bend.

**Short Tube Entry:** A minimum of tube springing is required because of the external flare seat. A decided advantage when working in close quarters.

**Straight Threads:** Adequate threads provided both on fitting and nut allowing use of a wide variety of tube wall thicknesses.

**Quality:** Precision made to aircraft quality rather than to ordinary commercial tolerances. Shapes made from forgings. Straights from barstock.

**Pressure Drop:** Drilled passages through fittings approximate I.D. of tubing, minimizing pressure drop.

**Pipe Threads: Dry Seal American (National) Std. Taper (N.P.T.F.).**

**Industry Standards: DEECO fittings exceed requirements of Army-Navy specifications MIL-F-5506 (formerly AN-F-47) as required by the J.I.C. Hydraulic Standards, and conform completely to SAE Standards and ASME Standards called for in the Code for Pressure Piping.**

**Straight Tube Connector:** Provided with large hex to accommodate "O" ring seal for use in straight thread bosses of pumps, valves, cylinders, etc.

**Tube Reducer:** One piece construction allowing reduction to one size lower or more from any given size which cannot be done with reducers of two piece construction.

**The Deutsch Company . . . America's largest producer of aircraft fittings . . . has for many years manufactured precision parts for the aviation and industrial fields.**

**Deutsch recently developed new forging techniques for fast production of precise, quality fittings. Result: Low cost manufacture, fast delivery, savings for buyers.**

**Write for FREE catalog No. 53 and 53B price list.**

**Deutsch Industrial Fittings Are Stocked By These Hydraulic Specialists**

Beverly, Mass.—Robert P. Podgers Co., 337 Cabot Street
Buffalo, N. Y.—J. V. Tripoli & Co., Inc., 223 Erie Street
Carnegie, Pa.—R. C. McKee Co., 1943 Borland Avenue
Chicago, Ill.—Jarvis Engineering, 4804 West Chicago Avenue
Dayton, Ohio—Scott Equipment & Engineering Co., 1316 Lorain Avenue
Denver, Colo.—Aviation Service & Supply Co., Stapleton Air Field
Detroit, Mich.—Industrial Components, Inc., Fisher Building
Montreal, Quebec—Precision Hydraulics Corp., 463 St. Catherine St. West
New York, N. Y.—Hummel Technical Products Co., 90 West Street
Olmsted Falls, Ohio—R. W. Nichols Co., 7539 River Road
Pasadena, Calif.—Circle Seal Supply Co., 2181 E. Foothill Blvd.
Portland, Ore.—Tubesupply, 413 Weatherly Building
St. Paul, Minn.—Forcey Machine Tool Sales, 44 Endicott Bldg., 4th Street
Salt Lake City, Utah—C. H. Spencer Co., 210 W. 33rd Street
San Francisco, Calif.—The Adam-Hill Co., 244 Ninth Street
Seattle, Wash.—Tubesupply, 2453 Sixth Avenue South
Swarthmore, Pa.—Ernest A. Isberg & Co., 200 South Chester Road
Washington, D. C.—Joseph C. Soraghan & Associates, 1612 Eye Street, N.W.
Wichita, Kan.—Ficke Engineering & Supply Co., 305 Pattie Street

**Deutsch's method of packing fittings protects threads and will simplify your inventory control.**

**Several desirable territories are still open to qualified hydraulic equipment distributors**

**THE DEUTSCH COMPANY**

**7000 AVALON BOULEVARD • LOS ANGELES 3, CALIFORNIA**

# USEFUL LITERATURE

**You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation**

**FILTRATION EQUIPMENT** . . . A new eight-page brochure, A-943, issued by Industrial Filtration Division, Hoffman Machinery Corporation, presents the essential features and applications of their basic types of industrial filtration equipment. These include disc, cartridge and pressure type filters, filtration units, vacuum stills, magnetic separators and oil conditioners.

Circle 200 on Reader Service Card

**MOLDED RUBBER PARTS** . . . The Parker Products Division, The Parker Appliance Co., has released catalog 5201A1, illustrating and describing many custom molded rubber parts, such as seals, gaskets, seats, rings, grommets, insulators, cushions, mounts and shims. Information on design possibilities is also presented. The Parker engineering service available to users of standard and custom molded rubber parts is outlined.

Circle 201 on Reader Service Card

**INDUSTRIAL THERMOMETERS** . . . In Bulletin E-2, a new 16 page publication announced by Precision Thermometer & Instrument Co., industrial thermometers, both mercury-in-glass and bimetallic are presented. A summary of technical data, details of construction, temperature scale ranges and various forms of mercury-in-glass industrial thermometers in conventional case sizes is included. A complete listing of thermometers for installation in ducts, piping and pressure vessels is shown. Thermometers of the separable socket type, which includes completely dimensioned sketches of all standard sockets are also featured.

Circle 202 on Reader Service Card

**HYDRAULIC PACKING** . . . A 2 color, 24 page illustrated catalog has been issued by the Stillman Rubber Co. Many custom molded parts including thermolastic and synthetic rubber "O"-Rings, Teflon Back-up Rings and hydraulic packings are produced by this company. The new Permadizing process for rubber-to-metal bonding is described in the catalog. Engineering and design information is also included.

Circle 203 on Reader Service Card

**VERTICAL PUMP MOTORS** . . . The Louis Allis Co. has released Bulletin No. 1250, which presents hollow shaft and solid shaft vertical pump motors and their features. The non-reverse ratchet is shown which prevents damage to the pump due to accidental reversal of the motor caused by the head of water draining back through the pump. Drip-proof, fan-cooled and explosion-proof type of constructions are shown.

Circle 204 on Reader Service Card

**BLEEDER VALVES** . . . Republic Manufacturing Company has released a complete catalog of needle, globe, check, relief, plug and special valves. Many sizes are available with J.I.C. tube, union, mpt and fpt connections, for 1500 psi service. Other units are recommended for service up to 3000 psi at temperatures from —65 F to 180 F.

Circle 205 on Reader Service Card

**HYDRAULIC RIVETING EQUIPMENT** . . . A new bulletin has recently been issued by Manco Mfg. Co., giving complete information on their standard hydraulic riveting heads, yokes and rivet sets. Included also is information and specifications on pump units and suspension balancers.

Circle 206 on Reader Service Card

**HYDRAULIC CONTROL VALVE** . . . Bulletin No. CO, released by Hydraulic Controls Co., Inc., illustrates and describes a control valve designed for use in follow up booster-type positioning systems mechanically actuated by cams or linkages. Specifications, typical characteristics and an installation drawing are shown.

Circle 207 on Reader Service Card

*For more reviews of recent literature turn to page* 192



Circle 59 on Reader Service Card

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

# 190 HORSEPOWER "led to work" through Eastman

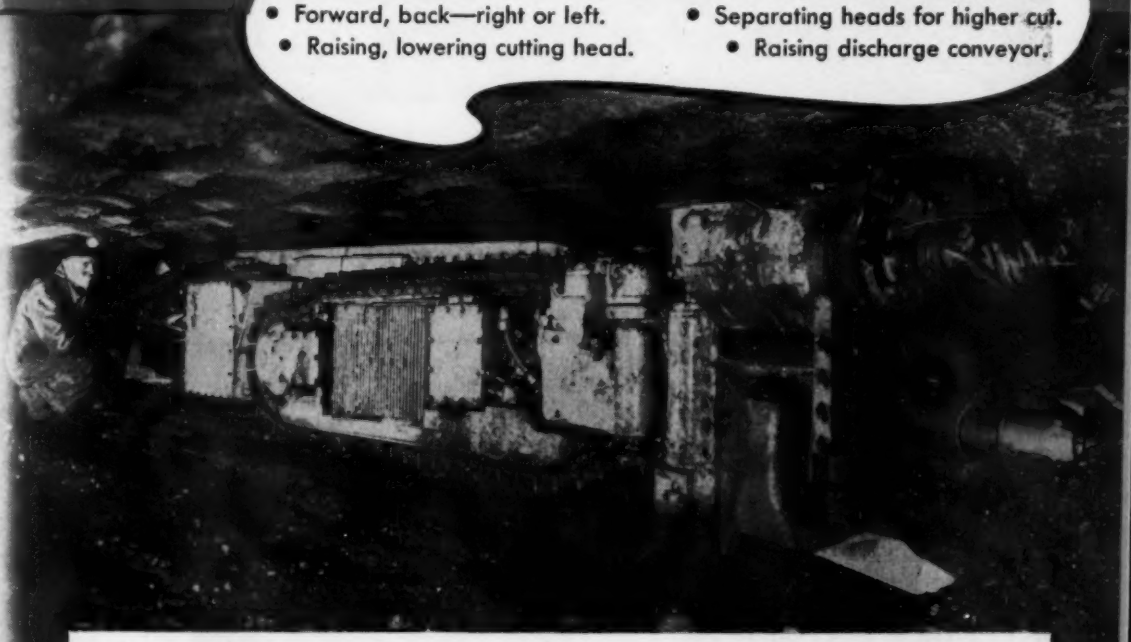
*first in the field*

# HYDRAULIC HOSE ASSEMBLIES

## enables the Jeffrey COLMOL to mine 3 to 5 tons of coal per minute

**Every movement and adjustment performed hydraulically**

- Drives arms that mine the coal.
- Forward, back—right or left.
- Raising, lowering cutting head.
- Tilting heads to follow veins.
- Separating heads for higher cut.
- Raising discharge conveyor.



The mechanical marvel shown in operation here . . . the 76-B Jeffrey COLMOL . . . is indeed a "mighty mole," capable of tunneling into a coal vein at a speed of two feet, or more, per minute—delivering from 50 to 100 tons of coal per man day.

Every movement and adjustment is hydraulically controlled through Eastman Hydraulic Hose Assemblies. Over 2000 psi is applied through 1¼" Eastman double braided hose, delivering 140 hp to 10 coal cutters which rotate at 50 rpm against the coal seam. Another 50 hp is independently provided for other hydraulic operations. Marvelous mobility is evidenced by the fact that this 25 foot, 35 ton monster can turn around in its own length.

The Jeffrey Mfg. Co., pioneers in the coal mining equipment field, have used Eastman Hydraulic Hose Assemblies on all their machines for over 20 years. Eastman Manufacturing Company, pioneer in its own field, too—is proud to have played a part in the development of the Jeffrey line.

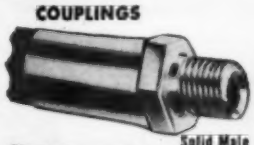
Call upon our 25 years of experience in the application of mobile hydraulic power . . . for greater efficiency in power transmission, lowest cost power delivery and most satisfactory performance. Engineering consultation at your call.

*Specify* **Eastman** *first in the field*

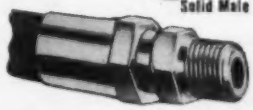
**HYDRAULIC HOSE ASSEMBLIES**

for the best performance, for long life and satisfaction—*all along the line*—from manufacturer to user. Check your needs on the following list:

**COUPLINGS**



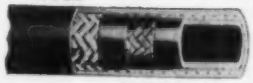
Solid Male



Swivel Male

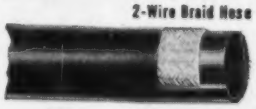
Swivel Female

**HOSE**



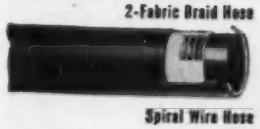
1-Wire Braid Hose

2-Wire Braid Hose



1-Fabric Braid Hose

2-Fabric Braid Hose



Spiral Wire Hose

*Write* for free catalog 101 on Eastman hose couplings and fittings.

# Eastman

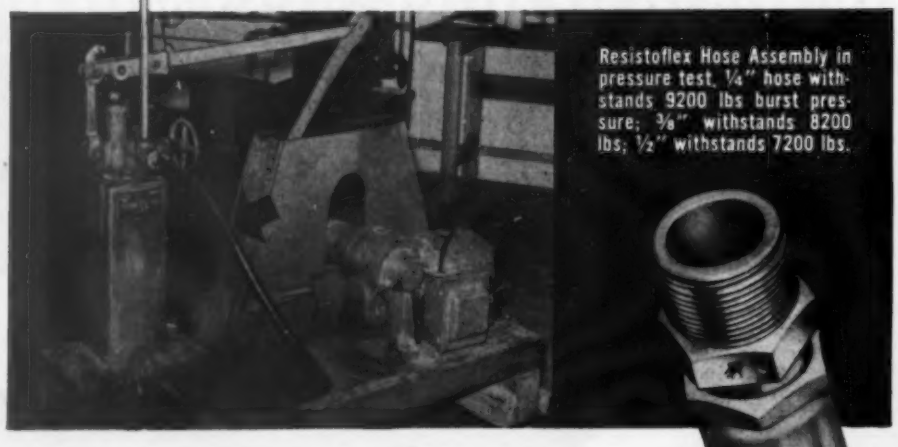
MANUFACTURING COMPANY

Since 1914

Dept. AH-10, Maniwotoc, Wisconsin

# never before . . . 9200 psi burst pressure

*with an all-synthetic hose*



Resistoflex Hose Assembly in pressure test. ¼" hose withstands 9200 lbs burst pressure; ⅜" withstands 8200 lbs; ½" withstands 7200 lbs.

***Superior flexing strength, too . . . in***

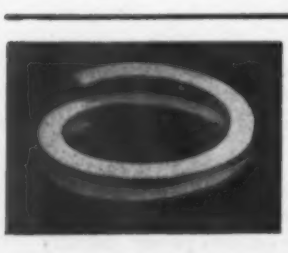
**RESISTOFLEX INDUSTRIAL HYDRAULIC HOSE ASSEMBLIES**

Such hose strength stems from a combination of special compar tube and modern synthetic yarns. Oilproof and non-aging, compar retains its initial high strength. Fortified with high tensile synthetic fibre braid, it needs no wire for medium-high pressure service.

This construction also provides five other outstanding features for *more hose value per dollar.*

1. *High Pull Strength*—as much as 3500 lbs for ½" hose—and couplings won't pull out even at this tension.
2. *Long Impulse Life*—virtually unlimited fatigue resistance to shock loads and impulse. Hose lasts longer.
3. *High Impact Strength*—hose returns to original cross section after crushing load.
4. *Full Flow at Fittings*—Less than 5% reduction in cross section at crimp.
5. *No Gumming or Clogging*—compar hose lines inert to all hydraulic oils.

*For more information, write for Data Sheet MH-1.*



**TEFLON® SPIRAL BACK-UP RINGS**

Made from uniform "Fluoroflex®-T" tubing—stress relieved before machining for dimensional stability of rings. These anti-extrusion rings withstand elevated temperatures. Self lubricating, they eliminate abrasion on "O" rings, reduce friction of the assembly. Chemically inert and non-fraying, they cause no malfunctioning of other hydraulic system components. Write for data sheet FR-1.

*®Resistoflex trademark*

**RESISTOFLEX** CORPORATION

Belleville 9, New Jersey

SPECIALLY ENGINEERED FLEXIBLE RESISTANT PRODUCTS FOR INDUSTRY

# LETTERS to the Editor

### Electronically Controlled Hydraulic Valves

In your August issue you published a letter on pages 42 and 44 from Mr. H. D. MacRae requesting information on electronically controlled hydraulic valves. We are enclosing drawings of electronically controlled valves we now manufacture. We will appreciate it if you would forward this information to Mr. MacRae.

IRVING KOTLIER,
Hydraulic Controls Co.

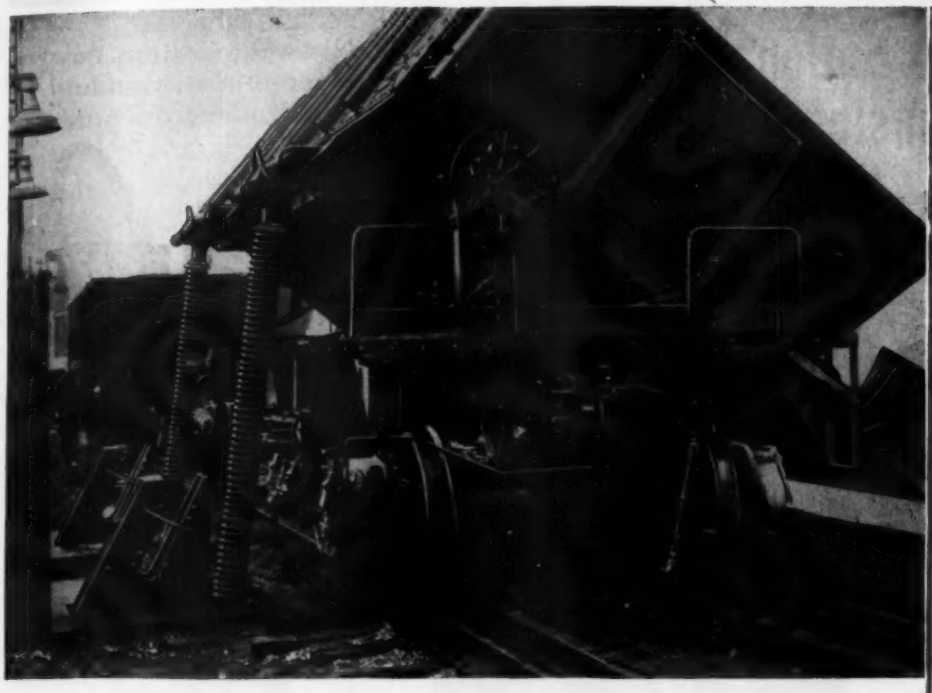
*Thank you, Mr. Kotlier. The prints have been forwarded to Mr. MacRae.*

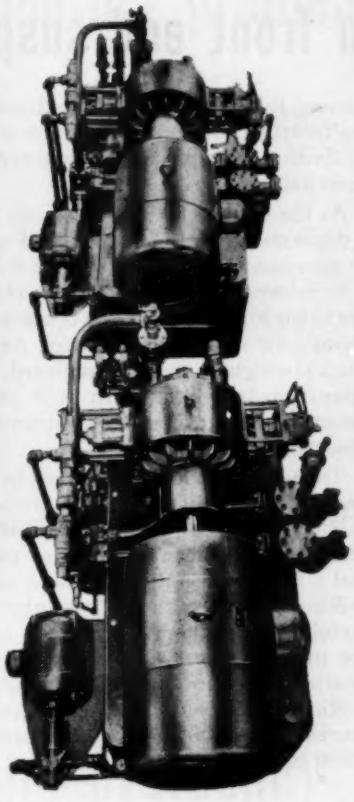
### Operating Time for Four-Way Hydraulic Valves

Two letters in your Letters to the Editor column in the August issue were of interest to me. I believe I can supply some of the information requested by Mr. John A. Zschiesche and Mr. Harry D. MacRae. Mr. Zschiesche asks for information concerning the time involved in operating four-way valves in hydraulic circuits. The Midwestern Geophysical Laboratory manufactures several valves of the subject type. The natural frequency of the electro-mechanical transducer (torque-motor) which actuates the valve pistons is approximately 325 cps. Assuming that the torque motor may be described approximately by an underdamped quadratic characteristic equation, the time constant will be approximately one millisecond. The "time constant" referred to is defined as the elapsed time from the instigation of an input step function to the instant when the output (displacement) first achieves its final value. The inertia of the valve piston is approximately equal to the torque motor armature; therefore, the time constant of the torque motor-valve combination will

Continued on page 50

# HOW TO DUMP A SLAG CAR in 2 minutes





## with HELE-SHAW

DUMPING A SLAG CAR at Jones & Laughlin's in Pittsburgh is "easy as rolling off a log." A new electro-hydraulic system... two hydraulic jack cylinders, each served by an American Engineering Hele-Shaw Pump... enables one operator at the push button controls to dump a car within two minutes. Synchronized pump action insures simultaneous functioning of the jacks, and identical speeds.

The Hele-Shaw is a radial-piston, variable displacement fluid power generator for oil pressures up to 3000 p.s.i. It is superlatively rugged... engineered and built for longest service life and maximum dependability. It is easily applied to the machine it serves... installed on the machine or remote from it. Discharge is infinitely variable from zero to maximum. Capacities range from 0.5 to 110 g.p.m.

Your American Engineering representative is qualified to analyze your hydraulic requirements, to design, to engineer and to furnish the necessary power units, and assume *local* responsibility for continuous, efficient service. He can also make unusually good delivery under present conditions.

Mail the coupon and we will send you full information about the Hele-Shaw . . . or the AE Hydramite for pressure to 5000 p.s.i.

At top: Dumping a car at the J&L slag disposal dock. Above: The two Hele-Shaw pumps which control the hydraulic jacks... The new facilities were devised by J&L engineers and the complete electro-hydraulic system was designed and built by Benjamin Lassman & Son, Glenshaw, Pa., AE representative serving western Pennsylvania and West Virginia.

***WHEN IT'S HIGH PRESSURE IT'S AMERICAN!***

**AMERICAN ENGINEERING**
COMPANY
PHILADELPHIA 25, PENNA.
In Canada: Affiliated Engineering Corporations, Ltd., Montreal 2, P. Q.
AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

American Engineering Company
2530 Aramingo Avenue, Philadelphia, Pa.

Gentlemen: Kindly send me complete information about the ☐ Hele-Shaw Pump. ☐ Hydramite.

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

# How Dart uses National O-Rings in front end suspension of 60-ton truck

Among the many unusual features of the new Dart 60-ton dump truck is the air-hydraulic suspension system for the front axle.

As the dual 18.00 x 25 tires roll into a depression, the fixed piston (Figure 2) moves downward. This forces S.A.E. #30 mineral oil from the piston chamber to the hollow piston and compresses captive air above the oil level. As the truck's weight presses downward, the operation is reversed. In both cases, counter-pressure between air and oil absorbs road shocks.

To insure zero leakage sealing in this demanding application, four National O-Rings are employed. Three O-Rings seal various piston or cylinder parts, and a fourth seals the oil intake valve. O-Ring diameters range from approximately 16" on the piston cap to 1" on the intake valve. O-Rings are all conventional National synthetic rubber O-Rings, designed to withstand temperatures up to 300° F and pressures to 1,500 p.s.i.

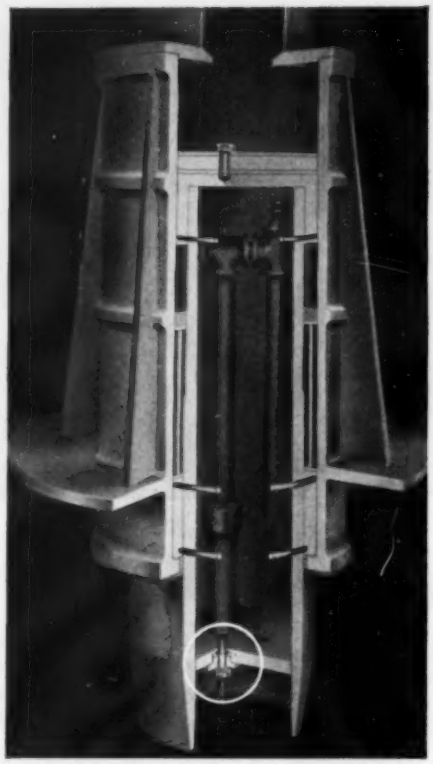


Figure 2. Dart Front End Suspension Unit

Figure 1. Dart Model 60 Truck

Standard-design National Oil Seals with single and dual spring-tensioned sealing lips (Figure 3) are also utilized in the truck—particularly in the wheel bearing assembly, planetary clutches and twin 350-horsepower engines.

Precision-made National Oil Seals and O-Rings are available in thousands of standard types and sizes. If conventional units do not precisely suit your application, modified or special seals can be designed. Call the factory-trained National Applications Engineer nearest you for complete information.

Figure 3. National 50,000 (left) and 10,000 spring-tensioned leather oil seals

## National O-Rings now offered in all standard sizes, commercial grade

National O-Rings are accurately compounded, precision-molded and trimmed O-Rings available in all standard sizes, commercial grade, for dynamic or static applications. They are available through National Applications Engineers in your area. Write or phone your factory-trained local National man for complete information and engineering help. His address appears below.

## New O-Ring catalog *free* to engineers

The new National O-Ring Catalog is designed for broadest usefulness in all industries utilizing O-Rings. Contains brief but complete information on dynamic and static application of O-Rings, gland-groove design, use of back-up rings, etc. Fully illustrated, lists all commercial grade National O-Rings and back-up rings. Write direct to our Redwood City, California office for your free copy, giving your name and title.

*"Let Your Decision be Based on Precision"*

**NATIONAL**
OIL & GREASE SEALS
O-RINGS SHIMS

**NATIONAL MOTOR BEARING CO., INC.**
**General Offices:** Redwood City, California
**Plants:** Redwood City, Calif.; Downey (Los Angeles County), Calif.; Van Wert, Ohio

*T. M. Reg.

2014

## CALL IN A NATIONAL APPLICATIONS ENGINEER

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DETROIT, MICH. . . . . *726 Lothrop Avenue, TRinity 1-6363*
DOWNEY (Los Angeles Co.), CALIF. . *11634 Patten Rd., TOpaz 2-8166*
MILWAUKEE, WIS. . . *647 West Virginia Street, BRoadway 1-3234*
NEWARK, N. J. . *Suite 814, 1180 Raymond Blvd., MItchell 2-7586*
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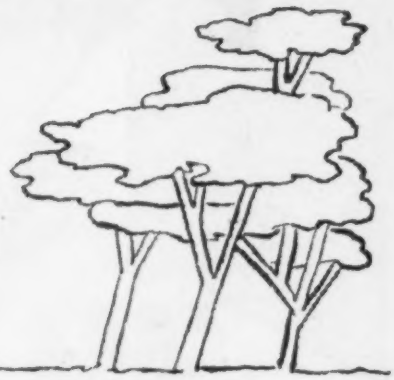
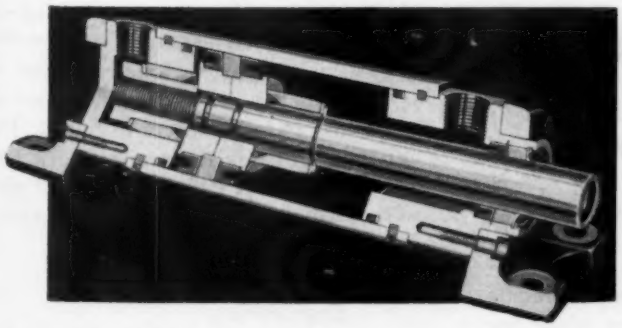
# Solve

## straight-line motion problems

*elevating*
*lowering*
*pushing*
*pulling*
*tilting*
*clamping*
*opening*
*closing*
*knock-out operations*



## with O-M CYLINDERS (air • hydraulic)

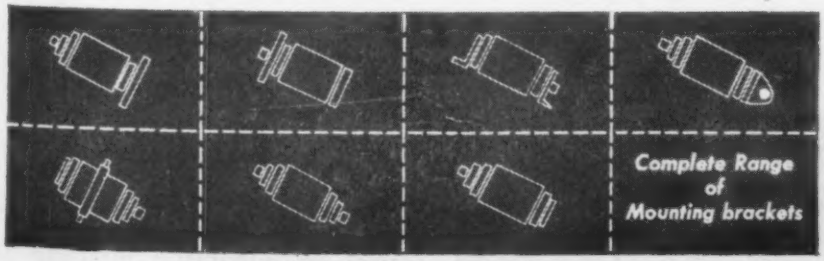


***Write today for FREE catalog*** and complete set of ½ and ¼-scale templates showing all cylinders and mounting brackets.

***14 day delivery on most sizes***

From a smooth, delicate push on a testing machine to a rugged thrust on a press application, O-M Cylinders handle all straight-line motion problems with ease and precision. *Special interlocking mechanism* eliminates needless tie rod • end caps . . . saves 1/3 INSTALLATION SPACE. Also assures better alignment, gives O-M the lowest coefficient of friction of *any* cylinder . . . smoother performance at low or high pressure regardless of length of stroke. End plugs tapped for universal mounting. Any one or combination of mounting brackets may be used to install . . . *without disassembling or changing cylinder.* Easily removed, inspected, repaired.

***Available in a full range of sizes*** (1½" to 8" bores) with standard, 2 to 1 or oversize rods. All machined steel with bearing bronze, no castings. Completely interchangeable parts.




*interchangeable bore for bore*

**ORTMAN-MILLER MACHINE CO.**
**1204 150th Street, Hammond, Ind.**

☐ Please send latest O-M Catalog
☐ Please send Complete Set of Templates

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Address.....
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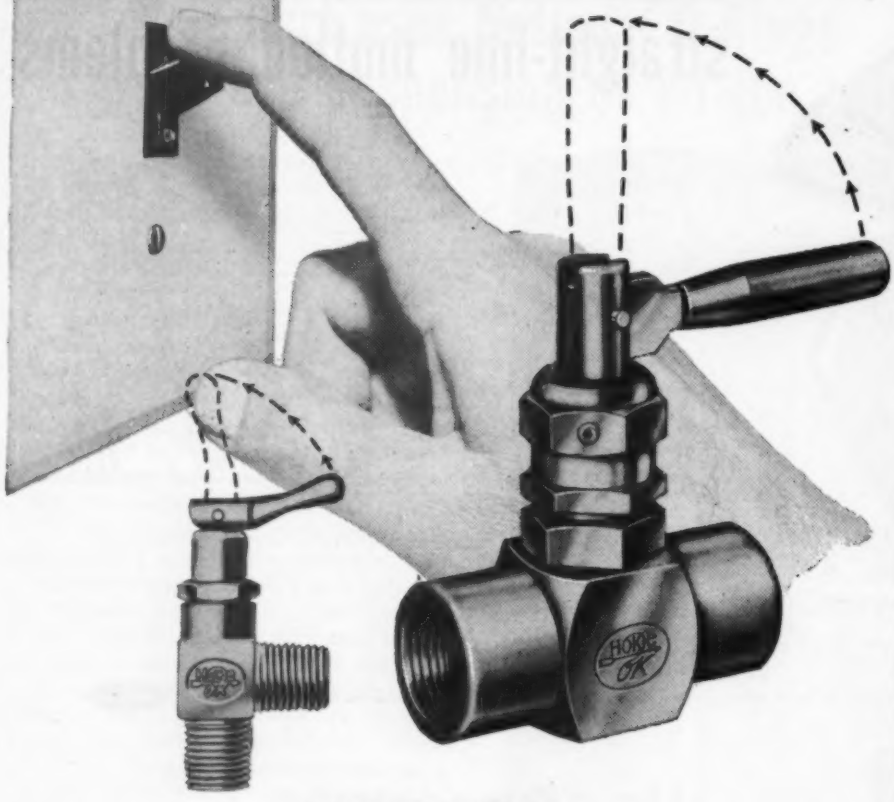
FOR Fingertip
FLUID CONTROL



HOKE
TOGGLE VALVES

Opened or closed with a single, positive motion—like a light switch—these HOKE toggle valves will improve the design of your instrument panel or test stand. Use them to control gas or liquid, at pressures up to 1000 psi or in high vacuum, with no leakage through stem or seat. They are available in ⅛", ¼", ⅜" and ½" sizes, in brass or stainless steel. The seat material, normally synthetic rubber, may be altered to meet specific conditions. Both straight line and angle type are ideal for instrument panel installation and can be mounted easily and securely with a lock nut. Several types are available with plastic knobs of various colors, for quick identification of fluids. For fingertip fluid control—for time-saving, dependable, efficient performance—specify HOKE Toggle Valves. Write Hoke Inc., 187 S. Dean St., Englewood, N.J., for Catalog & Data Sheets.

HOKE
HOKE INCORPORATED
Fluid Control Specialists
ENGLEWOOD, NEW JERSEY

## Letters to the Editor

Continued

be approximately 1.25 milliseconds.

Mr. MacRae requested information concerning "an electronically controlled hydraulic valve that will control the flow directly with the variation of an electric current." The valves discussed above are of this type. They may be controlled either with triodes or pentodes. Pentodes are usually used because of their higher output impedance. This tends to "swamp out" the inductance of the torque motor windings; thereby, moving out the break frequency of the electrical lag beyond the usable part of the frequency spectrum.

S. J. JATRAS,
Project Engineer,
Midwestern Geophysical Laboratory

### Open Port Air Filter

We are using a double acting hydraulic ram as a single acting gravity return type, and for various reasons, prefer to leave the unused ram port to atmosphere rather than hook it back to the reservoir as is common practice. Since this open port "breathes" with each motion of the ram and we are operating in dust laden air surroundings, we feel the need for some small air filter to protect the cylinder, but we are at a loss to know where to buy it. The port size this filter must work into is ⅜ inch N.P.T. If you could give us information on a source, it would be appreciated.

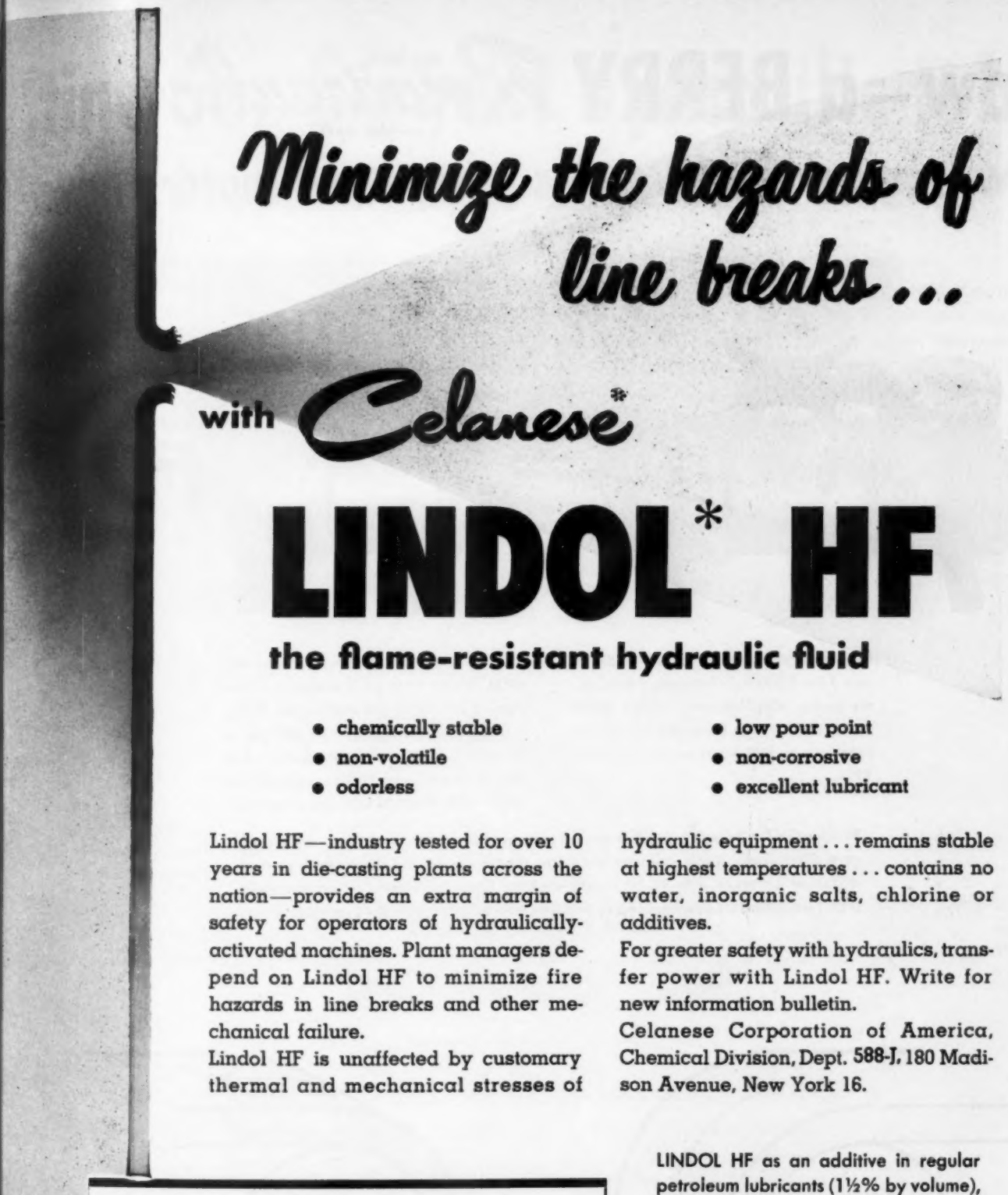
CHARLES DERLER,
Engineering,
Electric Tamper & Equipment Co.

*We've sent you a list of manufacturers who can supply a filter for your job.*

### No User Royalty on "O" Rings

I understand that the "O" rings which are used for piston seals in much of the equipment described in your magazine are a patented item. Could you tell me whom to contact for information regarding

Continued on page 54



# *Minimize the hazards of line breaks...*

## with Celanese*

# LINDOL* HF

## the flame-resistant hydraulic fluid

- chemically stable
- non-volatile
- odorless
- low pour point
- non-corrosive
- excellent lubricant

Lindol HF—industry tested for over 10 years in die-casting plants across the nation—provides an extra margin of safety for operators of hydraulically-activated machines. Plant managers depend on Lindol HF to minimize fire hazards in line breaks and other mechanical failure.

Lindol HF is unaffected by customary thermal and mechanical stresses of hydraulic equipment... remains stable at highest temperatures... contains no water, inorganic salts, chlorine or additives.

For greater safety with hydraulics, transfer power with Lindol HF. Write for new information bulletin.

Celanese Corporation of America, Chemical Division, Dept. 588-J, 180 Madison Avenue, New York 16.

**CELANESE LINDOL* HF**

| | |
|---|---|
| Appearance | Clear |
| Specific Gravity 20/20°C | 1.160±.008 |
| Boiling Range @ 10 mm. Hg. °C | 255—295 |
| Volatility, 6 hrs. @ 100°C, % max. | 0.1 |
| Flash Point, °F Tag open cup | 440—465 |
| Fire Point, °F Cleveland open cup | 685 |
| Auto Ignition Temperature, °F | over 1100 |
| Viscosity Range, Seconds Saybolt Universal @ 25°C. | 240—325 |
| Pour Point, °C | —25 to —30 |
| Weight, lbs/gal. @ 20°C | 9.7 |

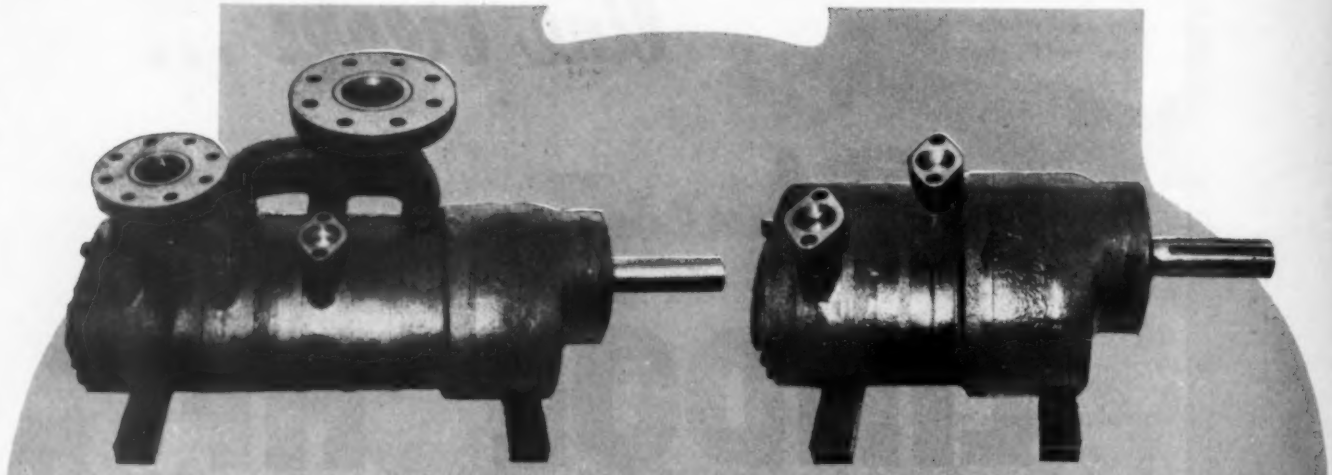
LINDOL HF as an additive in regular petroleum lubricants (1½% by volume), and in synthetic lubricants (5% by volume), increases film strength and lubrication value.

Celanese* CHEMICALS

*Reg. U. S. Pat. Off.

# Now—a BERRY *Rotodraulic* (TRADE MARK) unit

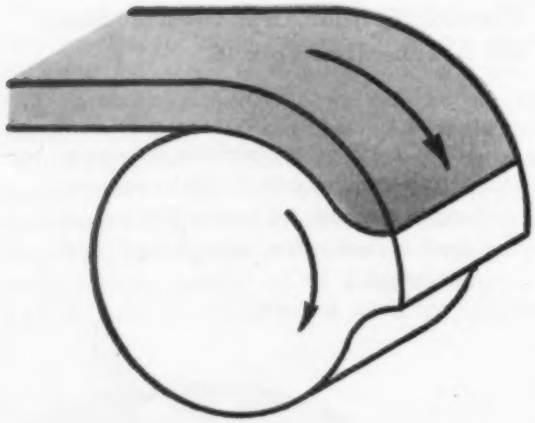
## New, rugged 32-10 series pumps and motors have

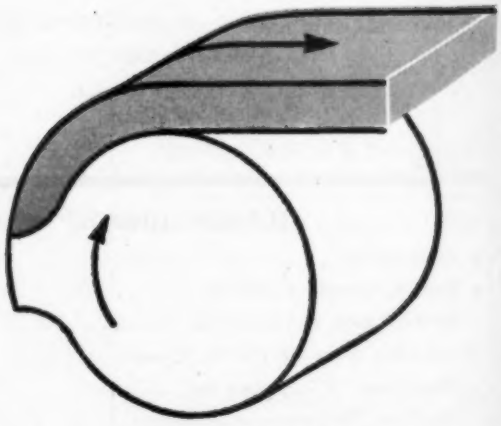


**Unit shown above, Model 32-10 E3, is rated for 1000 psi continuous service. As pump, displacement is 180 GPM at 1200 RPM. As fluid motor, unit is rated up to 300 horsepower at 2800 RPM.**

**Model 32-10 D1 above displaces 60 GPM at 475 RPM as a pump. It is designed for 1000 psi continuous duty. Intermittent service up to 1500 psi is permissible. As a fluid motor, this unit is rated up to 100 horsepower at 1087 RPM, and 6300 lb. ins. of torque.**

**Multi-cylinder Berry units offer the advantages of common suctions and separate discharges. Each cylinder thus can discharge to different services and different pressure. The 32-10 E3 shown here has a common suction manifold with two cylinders discharging to one line and one cylinder discharging alone.**





**Motors** Positive torque at all speeds down to zero is assured by the force of the liquid column under pressure acting on the torque arm of the rotary piston.

**Pumps** Positive displacement of the oil is assured as the unique Berry rotating piston sweeps its cylinder arc in every revolution — ***pushing*** the liquid column before it at the pressure required.

# for your *biggest* hydraulic job!

## unlimited applications, capacities up to 300 h.p.

Now ready to take on your heaviest assignment is the same revolutionary Berry rotating piston that has proved so successful in many industrial and petroleum field jobs.

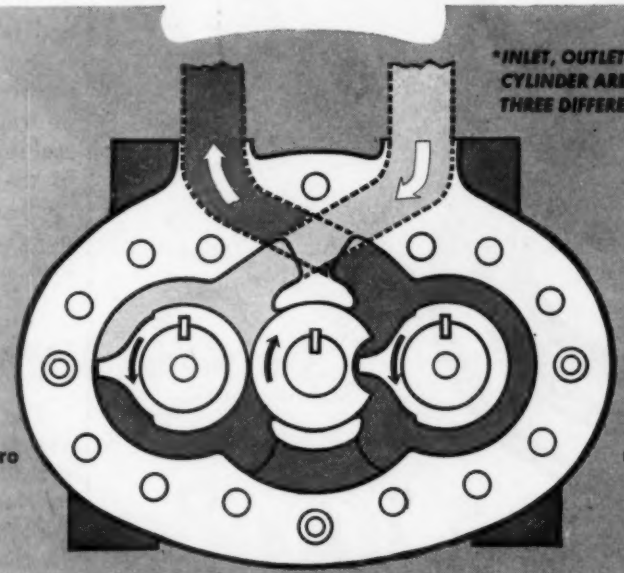
Industrial applications include saw-mills, machine tools, liquid fuel transports, draw-benches, drop forges, harvesting machines, extrusion presses, metal-working machines and many more.

In the oil fields, Berry units are powering vibrating screens, water pumps, mud mixers, wire measuring reels, bug blowers, pipe-wrapping machines and shot-hole drilling rigs.

Interchangeable as pumps or fluid motors and designed for overhung loads, Berry units are rugged, shock resistant, dependable, positive, economical, long-lived. Write us for full details or call your local distributor.

***A few suggested uses for Berry 32-10 Units:***

**• Steam Shovel Conversions • Winches • Hoists • Drag Lines • Earth-Moving Equipment • Drilling Rig Rotary Tables • Mining Machinery • Steel Mill Machinery • Large Saw Mills.**




***Pressures:***
**to 1000 psi continuous**
**to 1500 psi intermittent**

***Speeds:***
**motors — 2800 RPM down to zero**
**pumps — up to 1200 RPM**

***Ratings:***
**to 300 horsepower**

***Displacements:***
**motors — 138, 276, 414 GPM**
**pumps — 60, 120, 180 GPM**

***Torques*** **— to 21,000 lb. ins.**

### Only the BERRY design gives you all these:

**Positive Torque**
**Low Noise Level**
**Variable Speed**
**Long Life**
**Overload Protection**
**Series and Parallel Operation**
**Positive Displacement**
**Relatively Pulsationless**
**Instantaneous Reversibility**
**Rugged Dependability**
**Explosion-Proof Safety**
**Motor-Pump Interchangeability**

# BERRY DIVISION

ROTARY POWER

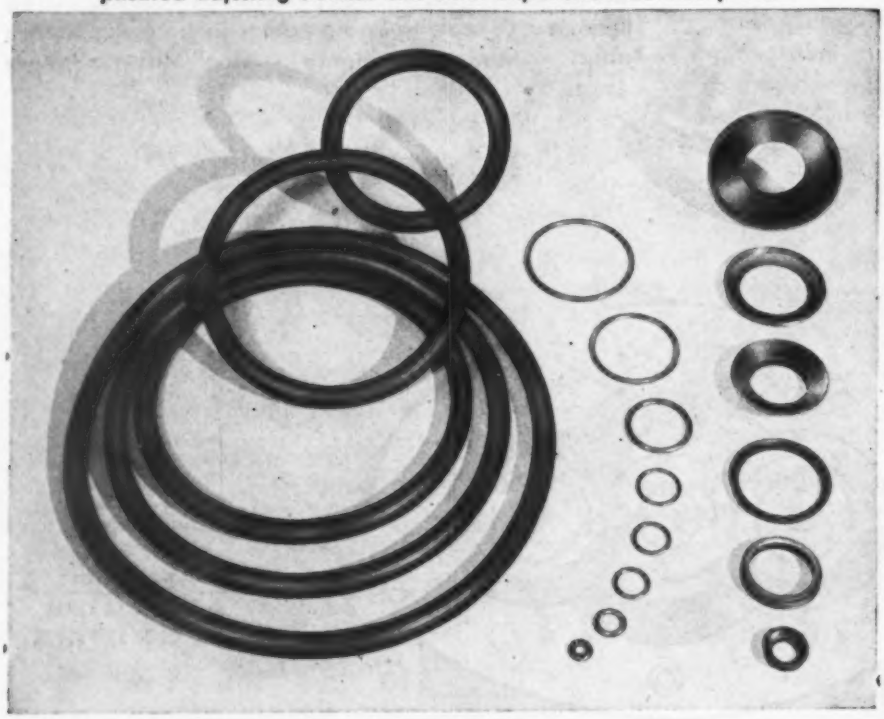
**Oliver Iron and Steel Corporation, Pittsburgh 3, Pa.**

Circle 23 on Reader Service Card

RINGS & SEALS
SYNTHETIC RUBBER

*Custom Engineered*

Synthetic rubber and Silicone "O" rings, lip-type seals and cups are constantly finding new applications formerly handled by leather, asbestos, flax and many other similar materials. They have been used in many applications to replace stuffing boxes, multiple packing sets, complicated adjusting devices and other expensive machined parts.



Acushnet produces great quantities of rings and seals to exacting specifications, and has developed many compounds and exclusive methods of fabrication for this type of part. Our long experience and quality controlled production assure the highest standard of precision. These items are made to order, none are stocked.

*Acushnet*
**PROCESS COMPANY**
New Bedford, Mass., U. S. A.

*Rubber Handbook sent on request.*

*Address all communications to 794 Belleville Ave., New Bedford, Mass.*


## Letters to the Editor

Continued

a license to use these rings in an item I wish to manufacture?

WALTER B. POWELL,
Powell Engineering Co.
Altadena, Calif.

*The basic patent for the "O" ring is owned by the estate of N. A. Christiansen. The arrangement for royalties are made by companies that manufacture "O" rings. There are no patent or royalty problems for the users of "O" rings.*

---

### Steel-Rubber Bonded Seal

In the February, 1953, issue, you published an article "Suggestions for Leakage Control in Hydraulic Systems." We are interested in obtaining information on a type of seal for use under bolt heads. This type of seal consists of a plated steel washer with a bonded rubber seal of trapezoidal section. The rubber seal is bonded to the inside diameter of the steel washer. We may have application for this seal and are also interested in contacting any American suppliers of similar types.

P. J. NAVIN,
Purchasing Research Engineer,
The Denison Engineering Co.

*The seal you refer to, shown in Figure 6 on page 40 in the article you identify is a design originated by Dowty Seals, Limited, a subsidiary of Dowty Equipment Limited, Cheltenham, England. This seal and other types of bonded seals, under the trade name of "Dyna-Seal" are made and sold in this country by Precision Rubber Products, Dayton, Ohio.*

---

### Double Check Shuttle Valve

Will you please tell us the source or sources of supply for the double check shuttle valve shown on page 108 of the July issue of APPLIED HYDRAULICS.

EDWARD T. CARR,
Bloomington, Ind.

*This type of valve is made by Westinghouse Air Brake Company, Industrial Division, Wilmerding, Pa.*

Continued on page 58

POSITIVE SEAL...
NO FLARING!
Line-to-line seal between tube and cutting edge of patented ERMETO sleeve.
Line-to-line seal between ERMETO sleeve and fitting body.

## Bothered by Vibration? Leakage? Pressure?

## *THEN YOU NEED*

# WEATHERHEAD ERMETO®

Now you can get a positive, leakproof, vibration-resistant seal for any pressure, low to extremely high—*without flaring and using a wrench as your only tool.*

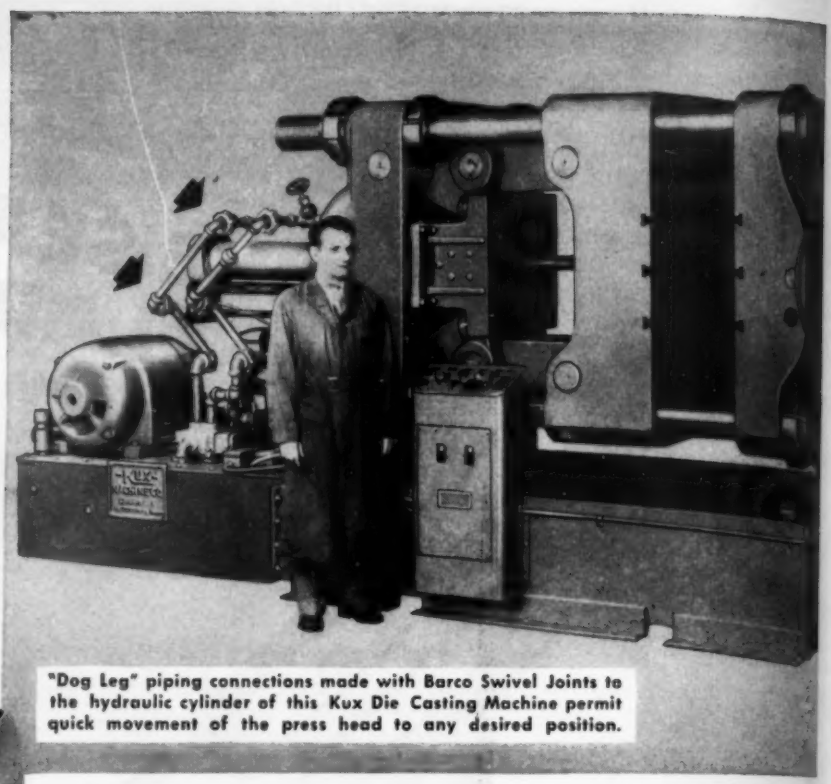
With the patented ERMETO design, the sleeve actually shears a groove into the outer surface of the tube when the nut is tightened. The result is a positive seal, for the life of the tube, regardless of how often the joint is disassembled and reassembled. Write for ERMETO Catalog E-1457.

**THE WEATHERHEAD COMPANY**
***Department A***
**300 East 131st Street**
**Cleveland 8, Ohio**

**the fitting that requires**
**NO FLARING • No Threading**
**No Welding • No Soldering**

*The Mark of Quality*
WEATHERHEAD
FIRST IN HYDRAULIC CONNECTIONS

# EVERY ENGINEER *will want a copy of this* NEW BULLETIN



"Dog Leg" piping connections made with Barco Swivel Joints to the hydraulic cylinder of this Kux Die Casting Machine permit quick movement of the press head to any desired position.

IT'S easy to get the right answer for even your most special hydraulic, steam, or air *piping jobs* when you use this new engineering catalog on BARCO SWIVEL JOINTS. It is complete with pictures and diagrams showing correct application and contains all specification data for *improved* Barco Swivel Joints:

- Leakproof! Perfect Sealing—Hot or Cold.
- No Binding, Low Torque! Trouble-free.
- Self-Aligning! Simplifies Installation.
- No Lubrication Required! Easy Maintenance.
- Economical! Wide Choice of Sizes and Styles.

Send for a copy of new Catalog 265A and complete information.

**BARCO**
*Manufacturing Co.*

**532 Hough St., Barrington, Illinois**
*In Canada:* The Holden Co. Ltd., Montreal

# BARCO *Swivel Joints for* HYDRAULIC APPLICATIONS

SAFETY is one significant reason for using Barco Swivel Joints on HYDRAULIC APPLICATIONS. Pressures often run to 3,000 psi, or more. For such service, metal piping and flexible joints offer important advantages. *Non-rigid* type connections can burst instantly without warning, causing injuries to personnel, fire, and waste of valuable oil. *Insurance companies counsel against such hazards.*

In contrast, Barco Swivel Joints are *pressure-safe* and also *fire-safe.* Even if a joint should wear, there is only a slight seeping of fluid—no bursting nor fire hazard. High shock loads can be handled without danger. Barco joints also give more positive hydraulic control as there is no "mushiness" caused by stretching of hose.

## *High Pressure Hydraulic* SWIVEL JOINTS

BARCO High Pressure Hydraulic Swivel Joints for ¼", ⅜", ½", and ⅝" O.D. Tubing, or comparable pipe sizes, are listed and described in Bulletin 269. These joints are built to 3,000 psi working pressure standards and meet Military Specification J-5513A. ASK FOR BULLETIN.

# RACINE

**ALL COMPONENTS**
**FOR ANY HYDRAULIC CIRCUIT**

*"They work better together"*

WRITE FOR NEW CATALOG AND
NAME OF NEAREST FIELD OFFICE.
Complete Engineering Service
Available without charge. Address:

**RACINE HYDRAULICS & MACHINERY, INC.**
**2074 ALBERT ST., RACINE, WISCONSIN, U.S.A.**

RACINE HYDRAULICS & MACHINERY, INC. RACINE, WISCONSIN

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**MARSH research leads again with a new *improved* quality impregnated mechanical leather!**

Marsh leads in better Leather Packings, because –

- Only packing leather specifically tanned to Marsh rigid specifications is used.
- Marsh continuing research on impregnations and quality control give you new packing material values – to improve the efficiency and acceptance of your products.

Marsh research has developed new, tougher – wear, age and extreme temperature resistant – mechanical leather packings which combine resilience and tightness with low friction.

**ENGINEERING AND CONSULTING SERVICE**

If you seal oil, water, air, vacuum, gas, gasoline, naptha, alcohol or other fluids, ask Marsh for field engineering service.

FEATURES: Low coefficient of friction — both static and running, greater wear resistance, tighter sealing, better high and low temperature stability, improved lubrication potentials, longer life.

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## Letters to the Editor

Continued

### Automatic Leveling of Hydraulic Elevators

The second item under "Trends" on page 24 of the August issue of APPLIED HYDRAULICS states that the problem of automatic leveling of hydraulic elevators has been solved by "elevator people." I would be very much interested in receiving information as to which manufacturers have solved the leveling problem and in receiving references to literature describing their methods.

GEORGE E. LOMAS,
Bureau of Ships, Code 522,
Department of the Navy

*There are a number of manufacturers of hydraulic elevators. Two that have worked out automatic leveling devices are: F. Rosenberg Elevator Company, Milwaukee, Wis. and Rotary Lift Company, Memphis, Tenn. These and other elevator companies will be able to furnish technical literature and cooperate in answering your specific questions.*

---

### It Wasn't the "Biggest"

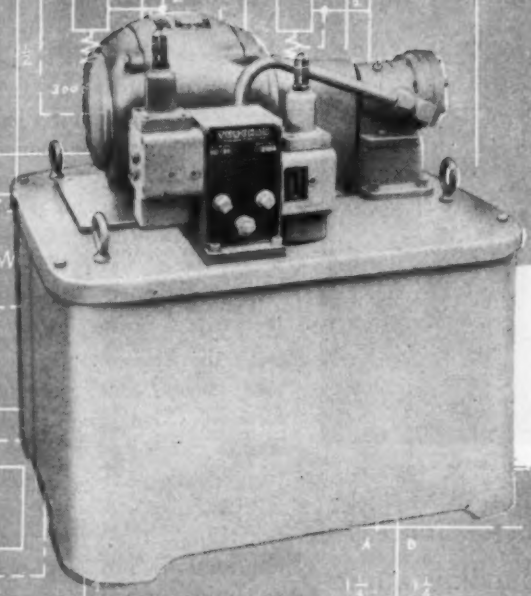
The August issue of APPLIED HYDRAULICS contained an article "Air Power Handles Biggest Mixer." This is somewhat in error. Our company has built large concrete mixers of both the tilting and non-tilting types and our subsidiary company, the C. S. Johnson Company of Champaign, Ill., has been building concrete mixing and batching plants for about 30 years. It may interest you to know that the largest concrete mixing plant was the one used at Grand Coulee Dam, built by the C. S. Johnson Company in 1935. Originally there were two mixing plants each with four 4 cubic yard mixers. On the last half of the job, the equipment was combined in one plant of eight 4 cubic yard mixers. It made the world's record pour of mixing 20,100 cubic yards of concrete, a rate of 40,000 tons in one 24 hour day. This plant averaged 18,000 cubic yards per 24 hours for 30 consecutive days.

This plant was entirely pneumatic operated with all the gates to the

Continued on page 60

Depend on *Turchan* for efficient

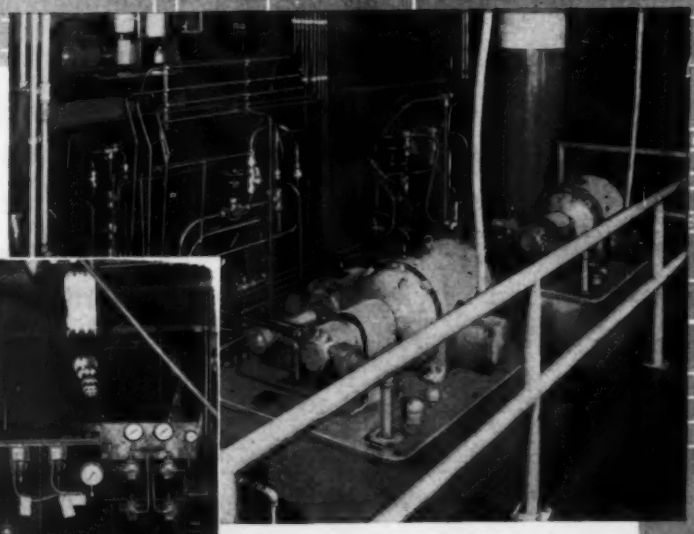
# HYDRAULIC POWER UNITS

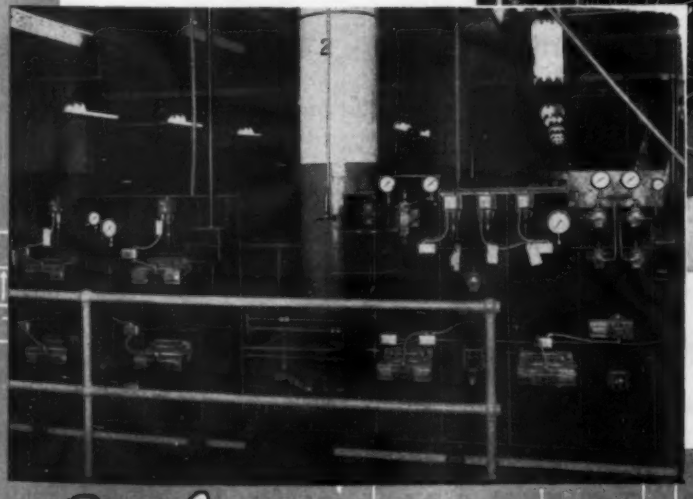


- Built to JIC standards
- Turchan standard units of a wide range in pressures and deliveries
- Special units built to meet your requirements

# or COMPLETE SYSTEMS

- A recent installation of electro-hydraulic servo-control system designed and built by Turchan control engineering experts





- Typical of many industrial servo-control systems designed by Turchan experts in over 20 years' experience

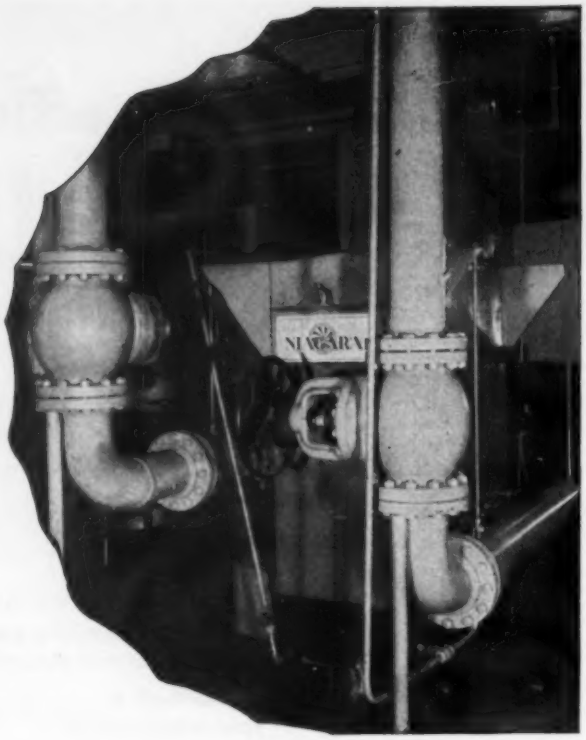
*You'll gain by discussing your control problems with our engineers.*

*Turchan* **FOLLOWER MACHINE CO.**

Control Systems Division, 8259 Livernois Avenue, Detroit 4, Michigan

Manufacturers of Servo Systems • Servo Valves • Cylinders • Flow Control and Shut Off Valves • and all Hydraulic Components

# How to get drier or cooler air or gases . . .



NIAGARA AERO AFTER COOLER cools a compressed gas, or air, below the temperature of the surrounding atmosphere, thus preventing the condensation of moisture in your lines. The gas will contain only half of the moisture left in it by conventional methods. Even drier gas can be produced if you require it.

In working with controlled atmospheres of inert gases to prevent undesired reactions, this dryness of the gas at low cost is a great advantage. The cost of the Niagara method is low because it uses evaporative cooling, saving 95% of the cost of cooling water (and its piping and pumping). This direct saving of cost pays for the Niagara cooler in less than two years.

If you use compressed air to operate tools or pneumatic equipment you save much in water and oil damage to tools and equipment, and in water damage to materials by using the Niagara Aero After Cooler.

Write for a bulletin, or ask nearest Niagara Field Engineer if you have a problem involving the industrial use of air.

**NIAGARA BLOWER COMPANY**

Over 35 Years' Service in Industrial Air Engineering

**Dept. AH, 405 Lexington Ave. New York 17, N. Y.**

*Experienced Field Engineers in Principal Cities of U. S. and Canada*


## Letters to the Editor

Continued

individual weigh batchers air-controlled through electric solenoid valves. The mixers were tilted by air. All of the batching was automatically controlled and the operator could select any one of six preset mixes at will. In addition to fully automatic weighing, the weights of each ingredient and the consistency of the concrete while being mixed were recorded on a single wide chart of paper, so that every batch of concrete had a graphic record of every ingredient that went into it as a quality control measure.

In the line of commercial ready-mix plants, the Fischer Lime and Cement Company in Memphis, Tenn., have had a plant in operation for five or six years equipped with two 4 yard tilting mixers with individual weigh batchers. All are operated by air rams with electric solenoid control for manual push-button or fully automatic operation. This plant is capable of producing as much as 200 cubic yards per hour or 1600 cubic yards per eight hour day.

E. O. MARTINSON,
Vice President, Engineering,
Koehring Company

*We appreciate the completeness of your letter, Mr. Martinson. And we are always glad to be corrected. We admit we did not take into consideration the mixing plants of the great dams or check with major builders who are specialists in building concrete mixing plants.*

---

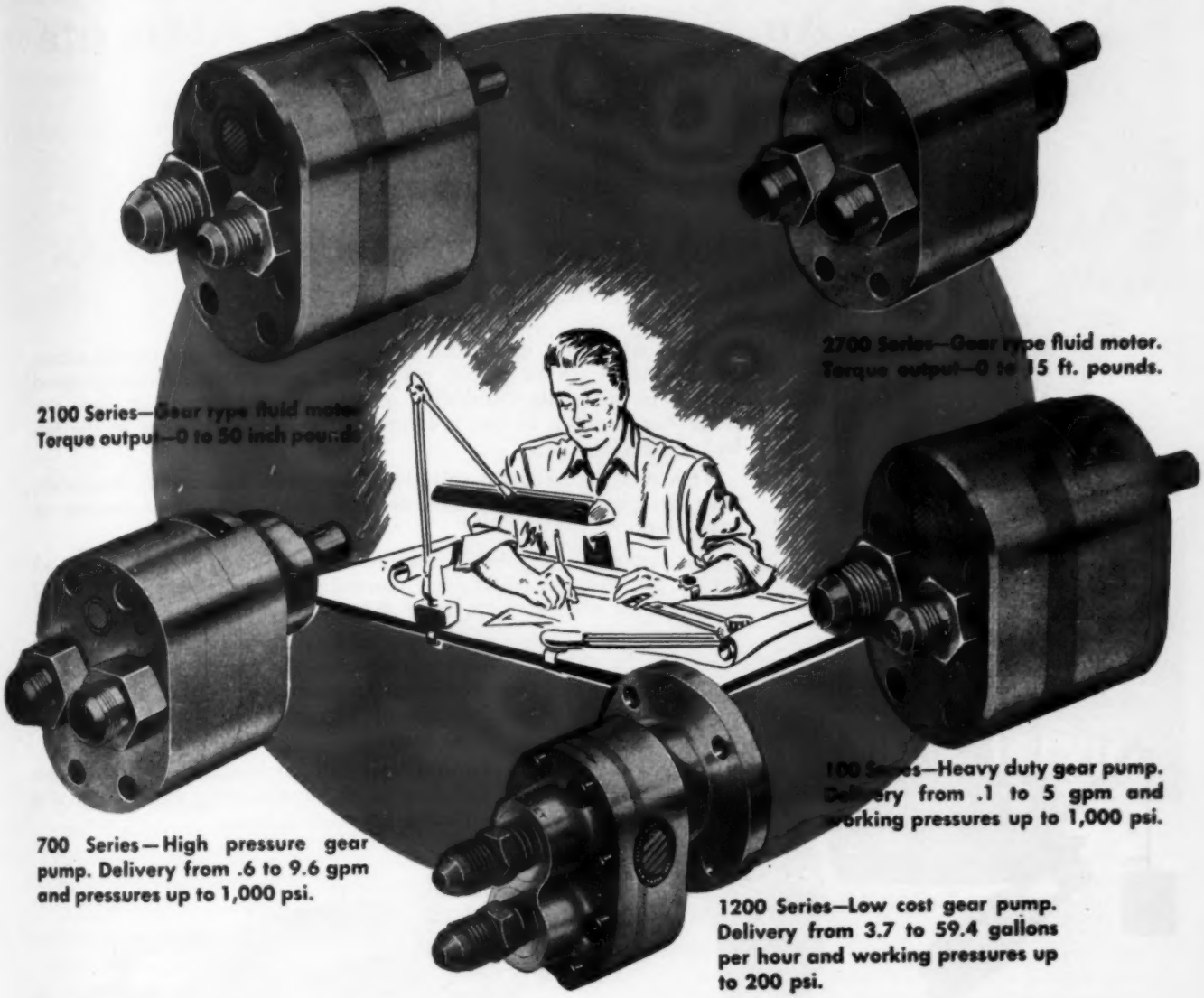
### Small Torquing Unit

On page 44 of your August issue appears a request from Alfred E. Pickard, Central Mine Supply Company for a small torquing outfit. I believe we have the answer to his problem. Data sheets describing this unit are enclosed. Will you please forward these to Mr. Pickard.

W. F. GRUSCHOW,
Hautau Engineering Co.

Continued on page 63

# To help you solve your design problems


2700 Series—Gear type fluid motor. Torque output—0 to 15 ft. pounds.
2100 Series—Gear type fluid motor. Torque output—0 to 50 inch pounds
700 Series—High pressure gear pump. Delivery from .6 to 9.6 gpm and pressures up to 1,000 psi.
100 Series—Heavy duty gear pump. Delivery from .1 to 5 gpm and working pressures up to 1,000 psi.
1200 Series—Low cost gear pump. Delivery from 3.7 to 59.4 gallons per hour and working pressures up to 200 psi.

# Eastern HYDRAULIC PUMPS AND FLUID MOTORS

**EASTERN** hydraulic pumps and fluid motors are designed and built to assure dependability and long life under rugged operating conditions. Their lightweight construction and simple compact design make them economically suited for hydraulic applications.

The aluminum alloy housing, nitralloy gears and shaft and close tolerances assure longer service, higher volumetric efficiency and more dependable operation.

**EASTERN** pumps and fluid motors feature compactness and are available in various types of mountings to permit convenience and space-saving installation.

When you have specified and installed **EASTERN** hydraulic pumps or fluid motors in your design, you are assured of having supplied the best for the heart of your hydraulic mechanism.

*Write to Dept. HC for Eastern Hydraulic Pump Catalog.*

**Eastern Industries Inc.**
296 Elm Street, New Haven 6, Conn.

# An Extrusion Press So Accurate
# *It Almost Thinks*
## Designed and Built by
## BENJAMIN LASSMAN & SON

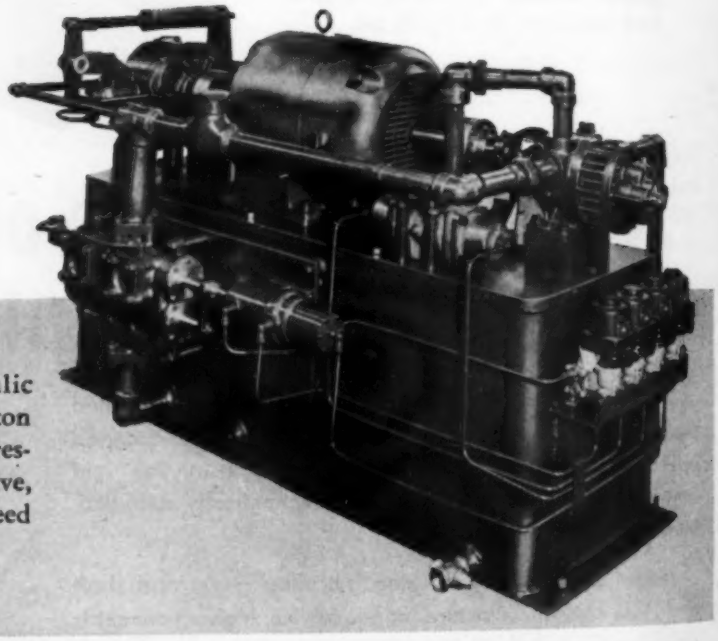
Imagine a 225-ton extrusion press, capable of an adjustable extrusion pressure up to 15,000 psi, whose adjustable extrusion speed MUST be minutely controlled to a small fraction of an inch per minute, regardless of the pressure and viscosity changes in the oil-hydraulic system.

This was the problem solved by Benjamin Lassman & Son when they designed and built this vertical press for the extrusion of explosives.

The speed of the press, adjustable from ½ inch per minute to 12 inches per minute, is precisely controlled by a linear speed control system especially developed for this installation.

The fine, pin-point engineering that accurately controls the many variables in this operation exemplifies the precision inherent in every product built by Benjamin Lassman & Son, specialists in the application and design of high pressure hydraulic equipment for over thirty years.

When your requirements call for specially-built Hydraulic Equipment, call first on the engineering knowledge and experience of Benjamin Lassman & Son.



This electrically, remote-controlled hydraulic pumping and control unit operates the 225-ton extrusion press. It consists of high and low pressure pumps, hydraulic directional control valve, pilot-operating system and incorporates the speed control equipment.

**Representatives in Principal Areas**

## BENJAMIN LASSMAN & SON

ENGINEERS & MANUFACTURERS SINCE 1921

ROUTE 8, GLENSHAW (Suburban Pittsburgh), PA.

HIGH PRESSURE HYDRAULIC EQUIPMENT . . . APPLICATION & DESIGN.



Circle 108 on Reader Service Card

## Letters to the Editor

Continued

*sheets have been forwarded to Mr. Pickard. If other readers are interested copies of the data sheets illustrating and describing the two-speed cycle of rapid traverse at high speed, low torque and automatic change to slow-speed high torque of a hydraulic nut-torquing mechanism will be sent on request. Hautau Engineering Co. is located at 721 Wanda, Ferndale, Mich.*

We've had requests for information concerning the National Fluid Power Association.

On page 190 you'll find the program for the Association's first fall meeting.

### An Age of Miracles

The age of miracles is not over. Imagine an American periodical admitting that they know nothing of the application of hydraulic power for lifting the clapper box on planing machines.

This device has been applied by many of the leading manufacturers of planing machines in Great Britain and Germany for many years with reasonably satisfactory results. Mr. Strachan would be well advised to contact the technical press in England regarding his problem. One wonders how much experience Mr. Strachan has had with hydraulics in general and would ask the question "how much trouble has he experienced due to over heating of oil in a one gallon tank"?

One wonders why he proposes to abandon the solenoid in favor of hydraulics; is it a question of efficiency or reduction of production costs? It is very interesting to note the change of design which has taken place in Germany showing a reversion from hydraulic tool to solenoid operation.

L. WALKER
Gateshead, England

*Until we received Mr. Walker's letter, we did not know of a planer using hydraulics to raise the clapper box. We told Mr. Strachan, whose letter appeared in these columns in July, that a hydraulic circuit was practical. We are glad to have this substantiated by Mr. Walker.*


STANDARDIZE
On this "Packing Package"

. . . for
Trouble-free
Hydraulic Service

Now, the United States Gasket Company offers you one source of supply and undivided responsibility in a complete line of synthetic rubber "O" Rings and companion Teflon* Back-up Rings for all military and commercial requirements.

- **CHEMISEAL "O" RINGS** of resilient, homogeneous synthetic rubber are absolutely non-porous and withstand a wide temperature range. They are available in both commercial and AN compounds.
- **CHEM-O-GREEN BACK-UP RINGS** are made of chemically inert duPont Teflon, colored green for identification purposes. They are made in three types, solid rings, split rings and the popular improved spiral type which adjusts itself to the groove and, on compression, becomes in effect, a solid ring of the required diameter and thickness.

The advantages of Chem-o-green (Teflon) Back-up rings are many.

Chemical inspections may be eliminated as Teflon is non-corrosive. Zero swelling in all hydrocarbons or newer synthetic hydraulic fluids or solvents. Service temperature range from minus 110° F to 500° F. Unsurpassed anti-friction properties. Water-proof, non-flammable. Long wearing. Requires no water-soak for installation.

Write for Bulletin OB-1152.

*duPont's trademark for its tetrafluoroethylene resin

UNITED STATES GASKET COMPANY
FLUOROCARBON PRODUCTS DIVISION
CAMDEN 1, NEW JERSEY
Representatives in Principal Cities Throughout the World

# NO OIL CHANGE IN 5 YEARS— HYDRAULIC SYSTEM "ABSOLUTELY CLEAN"

This report on the notable performance of *Texaco Regal Oil (R&O)* as a hydraulic medium comes from the Coleman Company, Wichita, Kansas, manufacturers of home heating and air conditioning equipment:

"Five years ago we put an initial fill of *Texaco Regal Oil (R&O)* into the hydraulic system of a 500-ton Verson press. In spite of the severe service we give it, the press has never had to be down for repairs and the hydraulic system has been completely free of sludge, rust and foam. When we recently moved the press from one building to another, we drained it and found the system absolutely clean, the reservoir spotless, and the *Texaco Regal Oil (R&O)* as clear as that out of a new sealed drum."

Hydraulic operators everywhere report similar fine results with *Texaco Regal Oil (R&O)*. This is the oil that tests show has *more than ten times the oxidation-resistance* of ordinary turbine-quality hydraulic oils — and far superior ability to prevent rust and foam. There is a complete line of *Texaco Regal Oils (R&O)*, approved by leading hydraulic manufacturers for all types of hydraulic equipment.

Why not assure better performance from *your* hydraulic machines? A Texaco Lubrication Engineer will gladly help you. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

**TEXACO Regal Oils (R & O)**

FOR ALL HYDRAULIC UNITS

# 1953 NATIONAL CONFERENCE on INDUSTRIAL HYDRAULICS

THE Ninth National Conference on Industrial Hydraulics will be held at the Hotel Sheraton, Chicago, on Thursday and Friday, October 8 and 9. With a program commensurate with the steadily growing influence of this major annual meeting, the 1953 Conference will present nine technical sessions. One session on industrial nonflammable fluids is being given for the first time.

**O. E. Teichman**
**1953 Conference Director**

O. E. Teichmann, Assistant Chairman, Heat Power Research Department, Armour Research Foundation and Director of the 1953 Conference, states that one of the strongest groups of papers ever given at a NCIH will make the Conference unusually attractive to many engineers and executives of companies who will attend for the first time. Carl E. Schmitz, Vice President, Crane Packing Company is Associate Director for this year's Conference.

**Carl E. Schmitz**
**Associate Director**

The National Conference on Industrial Hydraulics, founded and still sponsored by Armour Research Foundation and the Graduate School of the Illinois Institute of Technology, has become the outstanding technical meeting held annually that is devoted to the whole field of industrial hydraulics. The Conference now has the active support and cooperation of ten local and national engineering societies and of nearly one hundred manufacturers and users of hydraulic equipment.

Cooperating societies include the Illinois Section of the American Society of Civil Engineers; Chicago Section of American Society of Mechanical Engineers, Chicago Section of Society of Automotive Engineers; Western Society of Engineers; American Society of Lubrication Engineers; Chicago Section of American Institute of Chemical Engineers; Chicago Section of Institute of Aeronautical Sciences; American Society of Agricultural Engineers; Chicago Chapter, Illinois Society of Professional Engineers and Chicago Chapter, American Society of Tool Engineers. An Executive Committee of seventeen men, representing a wide range of industries in the greater Chicago area and leading technical schools, have been in charge of all details in the preparation of the Conference.

The first morning of the Conference will be devoted to registration and a general session. As in past years discussion panels will be an integral part of each technical session. There will be both prepared panel discussions and questions will be answered from the floor by both speakers and panel members. Meeting rooms will be closely grouped so that a visitor may attend several sessions alternately to hear papers or discussions in which he is particularly interested.

**Complete 1953 conference program appears on the following pages**

# Program of the National Co

*Philip H. Emerich*
*Chairman: General Session*

*Robert G. Tabors*
*Chairman: Presses*

*E. V. Crane*
*"Hydraulic Problems on Large Forging Presses"*

*R. O. Isenbarger*
*Chairman: Components*

THURSDAY, OCTOBER 8, 1953

8:30 A.M. Registration: Sheraton Hotel, Grand Ballroom Foyer

10:00 A.M. MORNING TECHNICAL SESSION

GENERAL SESSION: Grand Ballroom

Chairman: Philip H. Emerich, Manager, Product Service Department, Vickers Incorporated, Detroit, Mich.

1) Opening Remarks: Carl E. Schmitz, Vice President in Charge of Sales, Crane Packing Company, Chicago, Ill.
2) "Friction and Wear Phenomena", W. P. Green, Manager, Heat Power Research Department, Armour Research Foundation, Chicago, Ill.

Panel Members: To be announced

12:30 P.M. LUNCHEON SESSION: Tally-Ho Room

2:00 P.M. AFTERNOON TECHNICAL SESSIONS

AUTOMOTIVE: Boulevard Room

Chairman: Joseph Geschelin, Detroit Editor, Automotive Industries, Detroit, Mich.

1) "Hydraulics Applied to the Automobile Suspension." R. R. Peterson, Chief of Suspension Laboratory, Chrysler Corporation, Detroit, Mich.
2) "Hydraulic Mechanisms for Operating Auto-Window Lifts, Convertible Tops, Seat Adjustment, Windshield Wipers, etc." C. L. Kalitta, Chief Engineer, Warner Division, Detroit Harvester Company, Detroit, Mich.

PRESSES: Tropical Room

Chairman: Robert G. Tabors, Manager, Hydraulic Press and Power Tool Department, Baldwin-Lima-Hamilton Corporation, Eddystone Division, Philadelphia, Pa.

1) "Hydraulic Problems of Large Forging Presses." E. V. Crane, Chief, Special Development Engineering, and W. R. Jackson, E. W. Bliss Company, Canton, Ohio
2) "Self Contained Pump Units as Applied to Extrusion Presses". A. J. de Matteo, Chief Engineer, Watson-Stillman Company, Roselle, N. J.

Panel Members: Mr. M. D. Stone, Manager of Development, United Engineering Corporation, Pittsburgh, Pa.; E. L. Wefel, Vice President, Lombard Corporation, Youngstown, Ohio

PUMPS: Grand Ballroom

Chairman: J. W. Howe, Head, Department of Mechanics and Hydraulics, State University of Iowa, Iowa City, Ia.

1) "Boiler Feed Pumps". O. M. Kristy, Engineer, Centrifugal Pump Division, Allis Chalmers Manufacturing Company, Milwaukee, Wis.
2) "Ball Piston Pumps and Motors". H. Stern and W. T. Rauch, Development Engineers, General Electric Company, Schenectady, N. Y.

Panel Members: To be announced

5:45 P.M. SOCIAL HOUR: Tally-Ho Room

6:30 P.M. ALL SOCIETY BANQUET: Grand Ballroom

FRIDAY, OCTOBER 9, 1953

9:30 A.M. MORNING TECHNICAL SESSIONS

AIRCRAFT: Boulevard Room

Chairman: Dr. H. V. Hawkins, Director of Engineering, Globe Corporation Aircraft Division, Chicago, Ill.

1) "Aircraft Variable Delivery High Pressure Fuel Plunger Pump." John Pelz, Bendix Products Division, Bendix Aviation Corporation, South Bend, Ind.
2) "Economics of Standardized Maintenance and Testing in Airplane Fluid Systems." Julius Kendall, Vice President, Greer Hydraulics, Incorporated, Brooklyn, N. Y.

Panel Members: E. L. Shaw, Senior Design Engineer, The Denison Engineering Company, Columbus, Ohio

COMPONENTS: Grand Ballroom

Chairman: R. O. Isenbarger, Chief Engineer, Chicago Raw-

# nal Conference on Industrial Hydraulics

hide Manufacturing Company, Chicago, Ill.

1) "Fluid Carriers for Hydraulic Units in Earth Moving Equipment." J. E. Jass, Chief Engineer, Caterpillar Tractor Company, Peoria, Ill.
2) "Factors in Designing for Mechanical Seal Applications to Hydraulic Equipment." Justus B. Stevens, Vice President and Chief Engineer and Harold F. Greiner, Project Engineer, Sealol Corporation, Providence, R. I.

Panel Members: To be announced.

MACHINE TOOLS: Tropical Room

Chairman: V. Blasutta, Vice President-Engineering, Denison Engineering Company, Columbus, Ohio

1) "Evaluation of a Hydraulic Control for a Flight Simulator." D. Skoog, Electrical Engineer, Armour Research Foundation, Chicago, Ill.
2) "Development of Hydraulic Drive for Continuous Process Industries." Ramsom Tyler, Design Engineer, The Oilgear Company, Milwaukee, Wis.

Panel Members: John W. Pearson, Director of Development Engineering, Tape Division, Minnesota Mining and Manufacturing Company, St. Paul, Minn.

12:30 P.M. LUNCHEON SESSION: Tally-Ho Room

2:00 P.M. AFTERNOON TECHNICAL SESSIONS

INDUSTRIAL NONFLAMMABLE FLUIDS: Grand Ballroom

Chairman: J. C. Van Gundy, Technical and Research Division, The Texas Company, Chicago, Ill.

1) "Industrial Application of Nonflammable Hydraulic Fluids." D. Milne, Supervisor, Materials and Processes, General Motors Corporation, Detroit, Mich.
2) "The Effects of Synthetic Fluids on Hydraulic Components and Circuits." James Robinson, Chief Engineer, Vickers Incorporated, Detroit, Mich.

Panel Members: Dr. W. H. Millett, Carbide and Carbon Chemicals Company, a Division of Union Carbide and Carbon Corporation, New York; H. Stuart Litzinger, Monsanto Chemical Company, St. Louis, Mo.

TRACTORS: Boulevard Room

Chairman: L. Pfost, Chief Engineer, Tractor Division, Massey-Harris Company, Racine, Wis.

1) "Hydraulic System of the Golden Jubilee Ford Tractor." Harold L. Brock, Chief Engineer, Tractor, Engineering Department, Ford Motor Company, Dearborn, Mich.
2) "Hydraulic Actuation of the TD-24." W. W. Henning, Divisional Chief Engineer, Advanced Engineering, International Harvester Company, Melrose Park, Ill.

Panel Members: Frank W. Winters, Research Engineer, Caterpillar Tractor Company, Peoria, Ill.

INSTRUMENTATION: Tropical Room

Chairman: T. K. Breitfuss, Assistant to Director, American Concrete Pipe Association, Chicago, Ill.

1) "Pressure Transducers" for Industrial Research. R. E. Boyar, Development Engineer, Askania Regulator Company, Chicago, Ill.
2) "A Flowmeter for Measuring Mass Flow-Rate with a High Speed of Response." Dr. Yao Tzu Li, Research Associate, and Philip A. Lapp, Department of Aeronautical Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Panel Members: Willard L. Rogers, Assistant Professor, Department of Mechanical Engineering, Northwestern University, Evanston, Ill.; R. Byron White, Chief Engineer, Industrial Equipment Department, Control Engineering Corporation, Norwood, Mass.

**For abstracts of papers being presented at the conference see page 136.**

***V. Blasutta***
***Chairman: Machine Tools***

***J. C. Van Gundy***
***Chairman: Nonflammable Fluids***

***James Robinson***
***"Effects of Synthetic Fluids on Hydraulic Components and Circuits"***

***H. Stern***
***"Ball Piston Pumps and Motors"***

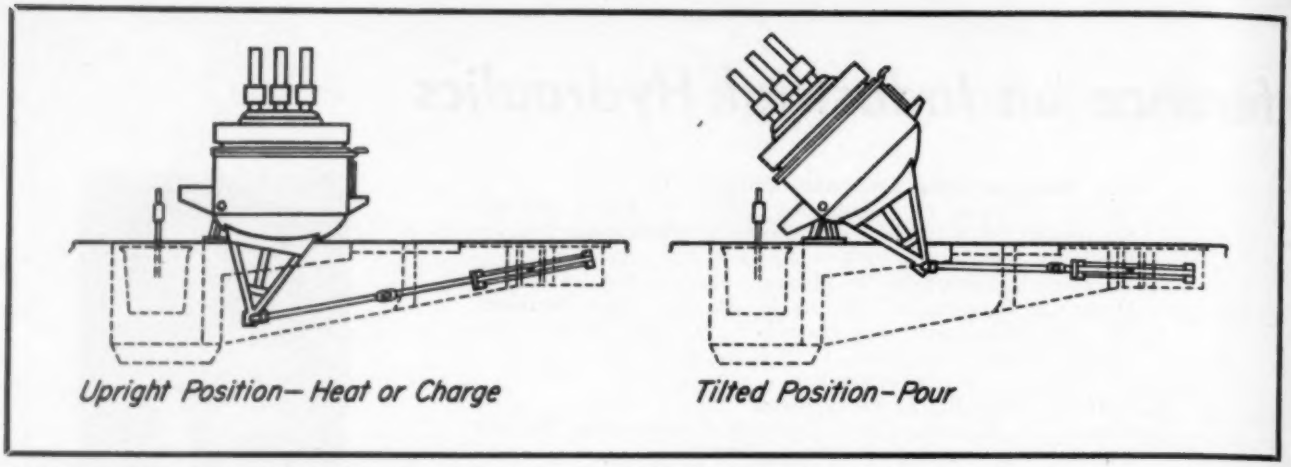



**FIG. 1. A 68 inch stroke, single acting, trunnion mounted hydraulic cylinder tilts this electric furnace. A 50-3/4 inch rod extension adds to the weight which must be supported by the rod and piston bearings.**

# How to Support Long Stroke Cylinders

**By Walter J. Kudlaty**

OPERATING LIFE of long stroke cylinders can be increased by incorporating a stop tube, between the piston and rod end head. Use of the tube will minimize side pressures on the rod and piston guides and seals. It should be emphasized that while the stop tube adds rigidity and will compensate for increased rod length, excessive side loads at the end of the rod are always dangerous and should be avoided. Care must be taken to avoid misalignment which would cause excessive loading.

**FIG. 2. Pouring of molten metal from this electric arc furnace is accomplished by the hydraulic tilting mechanism.**

A typical application of a long stroke cylinder requiring additional support against side thrust caused by the weight of a long rod is shown in Figure 1. This electric arc furnace, designed and built by the Whiting Corporation, is tilted for pouring by the action of a single acting pull type hydraulic cylinder. Tilting is accomplished by applying 800 psi oil pressure on the rod end of the cylinder to pull the rocker mounted furnace.

Cylinder requirements call for a stroke of 68 inches. The cylinder is trunnion mounted; the trunnion being located 41-¼ inches from the end of the retracted piston rod. A supplementary rod extension of 50-¾ inches is made necessary by the physical layout of the equipment.

The cylinder bore and piston rod size were first selected on the basis of the required pull of 25,000 pounds at 800 psi. This gave a cylinder having a seven inch diameter bore and a three inch diameter (cylinder manufacturer's standard) piston rod.

A piston rod which is subjected to a compressive force must be sized to possess adequate column strength to resist buckling. Two related factors must be care-

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*WALTER J. KUDLATY, Assistant Chief Engineer, Miller Motor Co., Melrose Park, Illinois*

FIG. 3. View of the long stroke cylinder in the pit behind the trunnion mounted furnace.

fully determined. They indicate the support the rod will receive at its ends to maintain rigidity and column strength within the tolerances of mating parts. The first of these factors is the fastening and guidance of the external end of the piston rod. The rod end may be free to move, it may be fastened squarely but loosely guided in a short bearing, or it may be fastened squarely and closely guided in a long bearing. The second factor is the type and location of the cylinder mounting. This is especially important when pivot cylinder mountings are used and the pivot is not at the head end of the cylinder. Both factors indicate the end support, or anchor, the rod will receive and the distances involved. The column strength of a rod depends on these conditions and on the direction in which the cylinder will operate.

A chart, shown in Figure 4, has been prepared to facilitate selection and checking of piston rod diameter based on the known thrust and dimension "L". Determination of dimension "L" for common cylinder mountings is also shown in Figure 4. On thrust appli-

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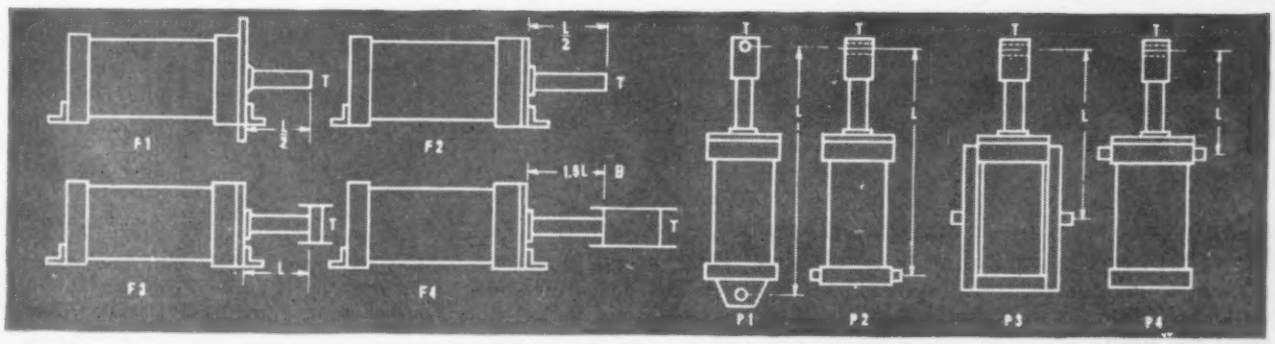



FIG. 4. Type F cylinders have fixed mountings; Type P have pivot mountings. All piston rods are shown in the extended position. "T" equals thrust in pounds. "B" refers to any long, closely fitted bearing anchored against a square shoulder of the piston rod solidly enough to be considered a fixed end, such as in planers. To find the proper piston rod diameter, first determine thrust "T"; then calculate value of "L". The piston rod diameter is shown in the table for various values of "T" and "L". Horizontally mounted cylinders are dependent on side support from the piston rod bushing to prevent buckling when the rod is extended. Additional side support is required when "L" is longer than 40 inches. To give this added side support use a longer stroke cylinder and restrict the extended piston rod position with a stop tube. One inch of stop tube is required for each 10 inches of "L" length beyond 40 inches.

## VALUES OF "L" IN INCHES ARE SHOWN IN THE TABLE BELOW.

| PISTON ROD DIAMETER | VALUES OF "T" IN POUNDS ARE THE HEADINGS OF THE COLUMNS | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 50 | 100 | 150 | 250 | 400 | 700 | 1,000 | 1,400 | 1,800 | 2,400 | 3,200 | 4,000 | 5,000 | 6,000 | 8,000 | 10,000 | 12,000 | 16,000 |
| 5/8" | 67 | 39 | 53 | 43 | 37 | 30 | 27 | 24 | 23 | 19 | 16 | 13 | 9 | | | | | |
| 1" | | 110 | 103 | 94 | 83 | 68 | 60 | 53 | 48 | 45 | 41 | 38 | 34 | 30 | 26 | 21 | 17 | |
| 1 3/8" | | | | 146 | 134 | 118 | 105 | 92 | 82 | 75 | 67 | 63 | 60 | 56 | 50 | 45 | 41 | 34 |
| 1 3/4" | | | | | 186 | 168 | 155 | 142 | 127 | 114 | 103 | 94 | 87 | 82 | 76 | 70 | 65 | 57 |
| 2" | | | | | | 202 | 190 | 174 | 160 | 145 | 130 | 119 | 110 | 102 | 93 | 89 | 84 | 75 |
| 2 1/2" | | | | | | 275 | 257 | 244 | 230 | 213 | 194 | 175 | 163 | 152 | 137 | 125 | 118 | 110 |
| 3" | | | | | | | 330 | 308 | 296 | 281 | 261 | 240 | 225 | 208 | 188 | 172 | 155 | 142 |
| 3 1/2" | | | | | | | | 385 | 366 | 347 | 329 | 310 | 289 | 274 | 245 | 222 | 210 | 188 |
| 4" | | | | | | | | | 440 | 415 | 400 | 378 | 360 | 342 | 310 | 279 | 269 | 235 |
| 4 1/2" | | | | | | | | | | 488 | 461 | 446 | 426 | 410 | 375 | 349 | 326 | 292 |
| 5" | | | | | | | | | | | | | 494 | 476 | 447 | 412 | 388 | 350 |
| 5 1/2" | | | | | | | | | | | | | | | | 482 | 454 | 420 |

# OIL POWER Handles Larger Loads

## . . . on redesigned railroad track maintenance machines

By W. H. Knippel

THREE years of field research and engineering have resulted in a ballast cleaner and winch car team which has speeded up right-of-way maintenance for railroads. In the redesign of the cleaner, oil hydraulics replaced air to do heavy raising and lowering jobs, and hydraulically powered mechanisms were added to improve the performance and capacity of the machine.

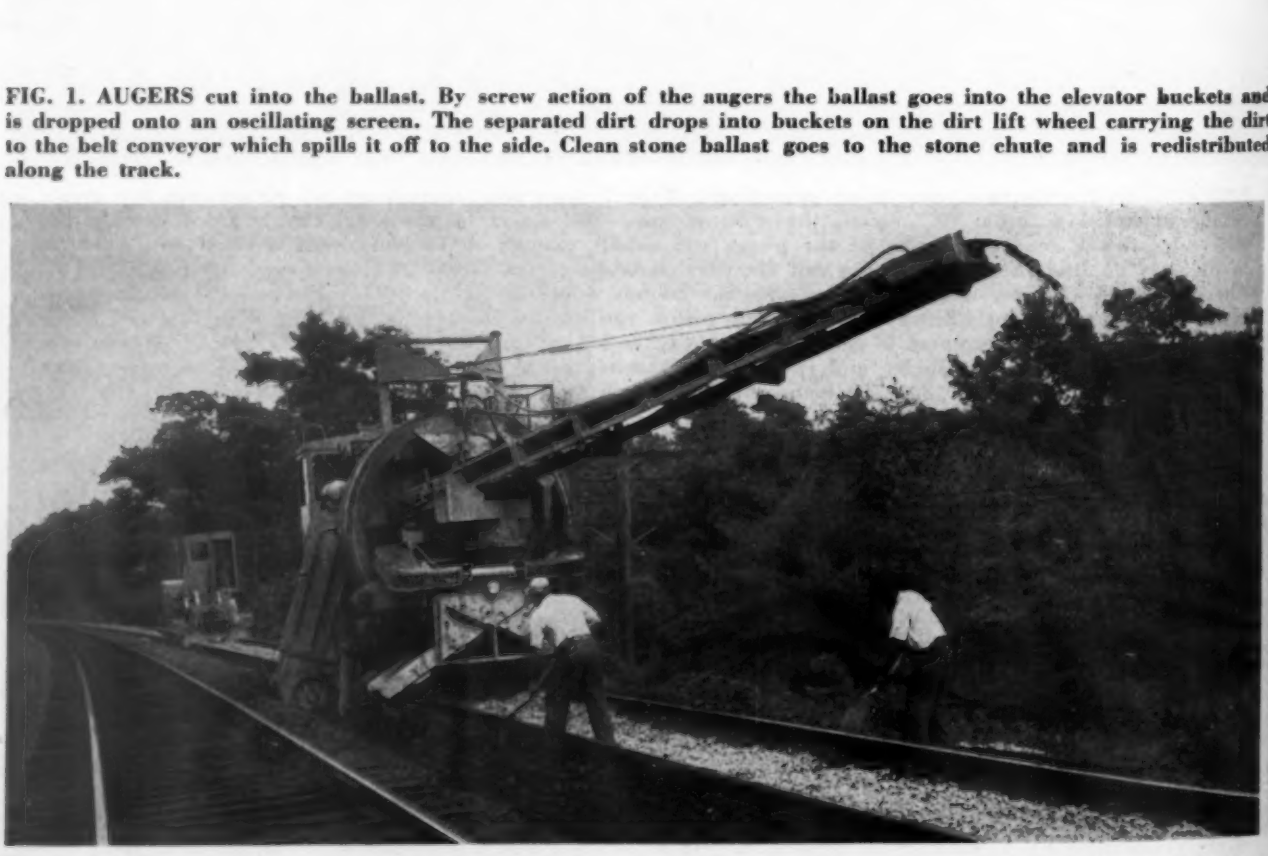
The cleaner unit, employing an operator and two laborers, is designed to pick up dirty ballast simultaneously from both shoulders of a single track or the shoulder and part of the six foot of a multiple track, clean it and redeposit it on the track as desired at a production rate of 1,000 to 1,250 feet per hour. The new unit is also designed with a capacity to clean both the shoulder and cribbed ballast when track has been previously cribbed at a rate of 600-900 track feet per hour.

One of the most important, new features of the Pullman ballast cleaner is the addition of the power track winch car for positive, variable speed propulsion of the cleaner in even the hardest cement ballast conditions. Figure 1 shows the cleaner in the foreground being pulled by the winch car.

The winch car, operated by one man, and propelled by a 40 hp diesel engine, runs ahead of the cleaner, unwinding cable for a distance of 500 feet, then anchors itself in place by means of two self-aligning hydraulic rail clamps (which are automatically self-compensating for varying rail gauge tolerances and

*W. H. KNIPPEL, Chief, Engineering Section—Track Equipment Division, Pullman Standard Car Manufacturing Co., Hammond, Indiana*

**FIG. 1. AUGERS cut into the ballast. By screw action of the augers the ballast goes into the elevator buckets and is dropped onto an oscillating screen. The separated dirt drops into buckets on the dirt lift wheel carrying the dirt to the belt conveyor which spills it off to the side. Clean stone ballast goes to the stone chute and is redistributed along the track.**



*Designers of mobile equipment look to oil power to operate auxiliary equipment. Pumps are easily driven from engine power take-offs; multiple section valve operation permits simple control from the operator's seat; large power is developed with compact, accessible low cost components.*

rail head designs) and then begins to winch in the cleaner. The rail clamp is designed not to slip on greased rail even with a full load of 30,000 pounds on the cable. The winch car employs an electric slip clutch safety device that slips at 30,000 pounds pull even though the cable has a breaking point of 60,000 pounds. This safety device protects the cleaner from damage in case it strikes obstacles submerged in the ballast. As an additional safety precaution, the winch car is equipped with a hydraulically actuated, overcenter, mechanical track lock or safety hook which will hold the winch car in place should the main rail clamp fail for any reason.

Figure 2 is a close-up of the winch car. The hydraulic clamp cylinders and lift cylinders are in the front. The 20 by 24 inch drum will accommodate 1,000 feet of 7/8 inch or 700 feet of 1 inch wire rope. A foot brake and jaw clutch are provided on the drum. The jaw clutch can be disengaged to allow the drum to turn freely when pulling the rope from the drum. The drum is driven through a chain drive from the diesel engine through two gear reductions.

A jaw clutched sprocket is provided on the intermediate driveshaft for use in powering a level-winding device insuring even spooling of cable on the drum.

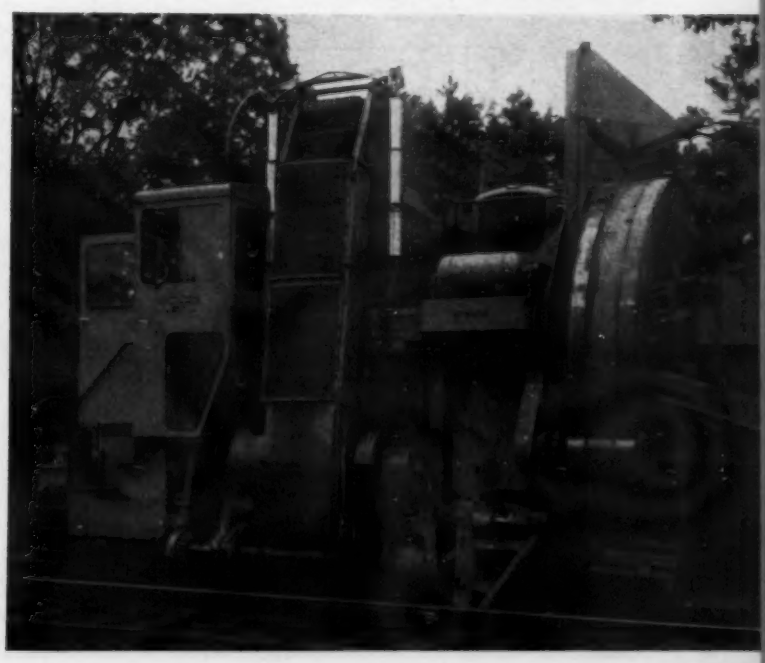
### *Uses Telescoping Cylinders*

A new design feature of the ballast cleaner is the auger which breaks up the cemented ballast and actually carries it back to the elevators much as a wood auger carries chips out of a hole. The augers are shown in the raised position in Figure 3. Telescoping cylinders, position the augers and elevator buckets.

Another design change in the new cleaner is the

**FIG. 2. CLOSEUP of the winch car which is hydraulically clamped to the rails as it pulls the cleaner along the tracks hundreds of feet ahead. Front set-off cylinders which raise the car from the tracks when the track must be cleared are visible.**

**FIG. 3. CLOSEUP of the ballast cleaner shows the auger and elevator buckets in the raised position. The three sleeve telescopic cylinders are extended. The dirt lift wheel is powered by friction rolls on both sides which are driven by fluid motors through a speed reducer.**



use of a revolving lift which carries the dirt ejected from the shaker screen to a top-mounted belt conveyor that carries the dirt away. The top location permits complete flexibility of adjustment of the distributing mechanism for the cleaned ballast so ballast can be replaced in the track at any desired location.

The dirt conveyor is hydraulically controlled from the cab and can be easily and almost instantaneously positioned by the operator to any point in its 140 degree arc. Thus the dirt can be wasted over the bank, over the second track to the opposite shoulder or to a car behind the unit.

The new cleaner weighs 80,000 pounds, is propelled by a 150 hp diesel engine which also drives the elevators, digger section, and a double hydraulic gear pump. An additional 40 hp diesel drives the vibratory screen and hydraulic vane pump.

Both the winch car and the cleaner are self-propelled, having a running speed of 25 mph, and either unit can tow the other when traveling. In addition, each has a powered lateral set-off mechanism.

## *Winch Car Hydraulic System*

On the winch car, oil power is used to raise and lower the rail clamps and to lock the clamps to the rails. Also a 1½ inch bore 29 inch stroke cylinder operates the safety hook. Four, 3½ inch bore 8 inch stroke, cylinders are capable of raising the car in less than four seconds preparatory to set-off from the tracks. A gear pump having a rating of 6.1 gpm at 2500 psi and 1200 rpm takes oil from a 7 gallon

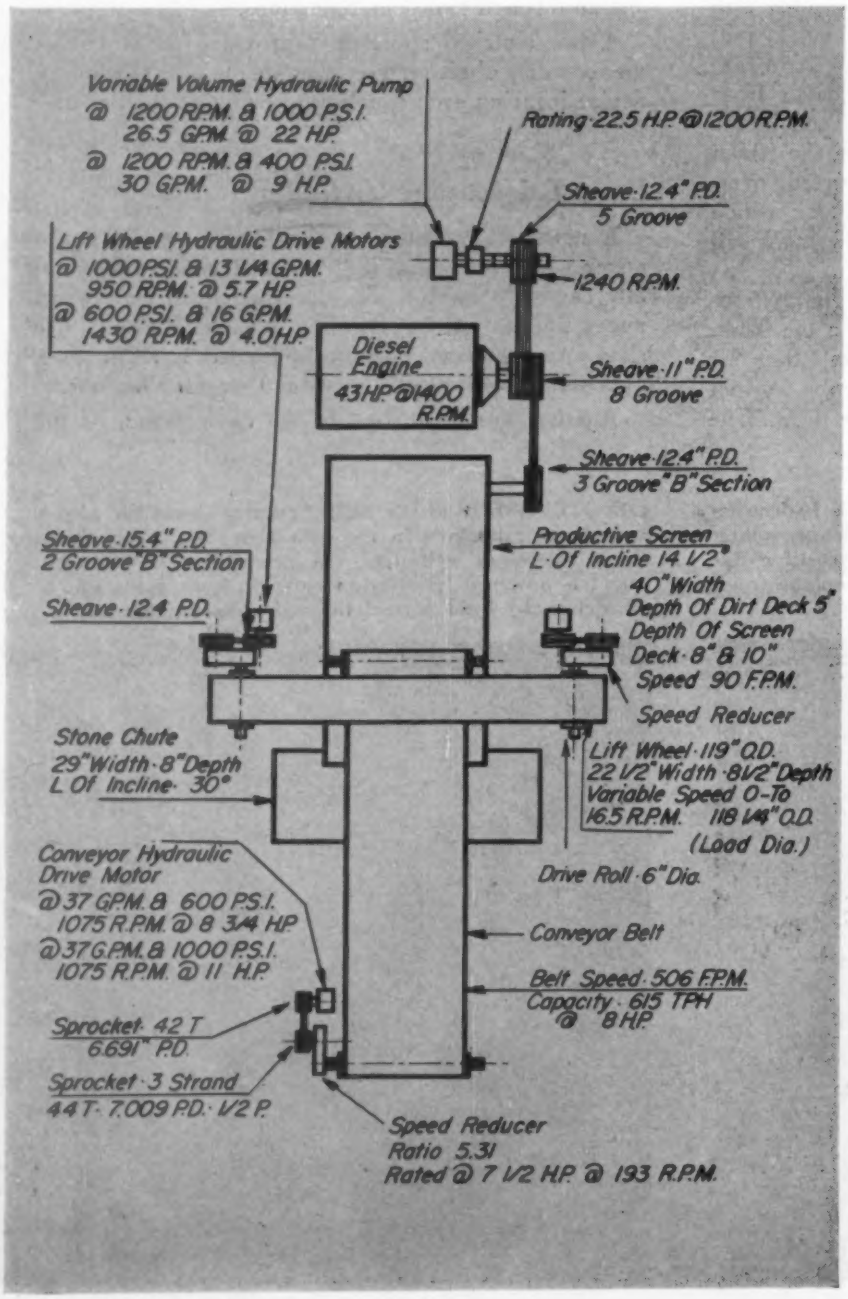



**FIG. 4. Plan view of the ballast cleaner's screen, dirt lift wheel and conveyor. The variable volume pump is belt driven from the diesel engine. The screen is also driven by the diesel engine. Oil from the pump drives the fluid motors which turn the dirt lift wheel. Oil power for the conveyor is supplied by a double pump driven by the main 150 hp diesel.**

reservoir to power the hydraulic operations. The main relief valve is set at 2500 psi as the maximum clamping pressure. A second relief valve set at 1000 psi limits the pressure to the lift and set-off cylinders. During most of the time the pump is unloading back to tank at near zero pressure through open center control valves. The pump only briefly develops a pressure of 2500 psi. It does so to charge a 1 pint capacity bladder type accumulator which serves to hold the clamping pressure while the winch car is locked to the rails.

Initial gas precharge in the accumulator is 1500 psi. A pressure gage gives visual warning of reduced clamping pressure caused by lost gas charge. Figure 5 shows the clamp circuit and the use of a pilot operated check valve to prevent loss of accumulator charge.

To keep the oil in the system clean, a 20 gpm strainer is in the pump suction line and a 20 gpm filter with a disposable cartridge is in the return line.

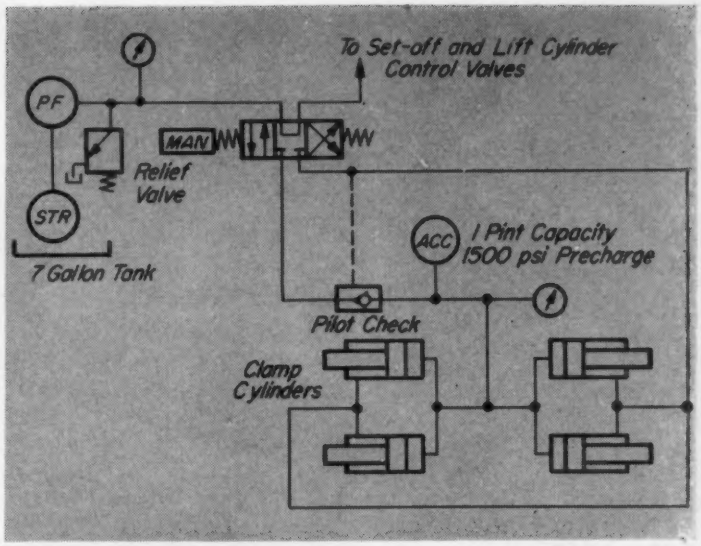



**FIG. 5. HYDRAULIC circuit for the rail clamps on the winch car. The accumulator holds the clamp pressure.**

## *Ballast Cleaner Circuit*

A double pump is driven from a power take-off on the main 150 hp diesel, which propels the cleaner when moving between work stations. The pump has a capacity of 36 gpm at 1800 rpm and 1000 psi. One pump section powers the front and rear set-off cylinders and the hydraulic motor which drives the belt conveyor. The conveyor motor will rotate at 1025 rpm with a supply of 36 gpm at 1000 psi. The second pump section supplies oil to the elevator lift and lock cylinders, and to the conveyor boom pivot cylinder. Multiple section series control valves operate the system. Operation of the machine seldom requires more than one oil powered function at a time. This makes it possible to use full pump volume for each operation.

The three sleeve elevator lift cylinders have a stroke of 54¾ inches; can be raised in 24 seconds and lowered in 3.5 seconds. These cylinders are important structural members, as well as power units. Their size was largely determined by a static force analysis made to carry the structural loads of the elevator. A short closed height of the cylinder is necessary for proper clearance when the machine is traveling through tunnels and under low bridges.

The conveyor is pivoted by a double ended cylinder which produces rotation by pulling a chain which is wrapped around a pulley and has its ends fastened to each piston rod end to complete a closed loop.

## *Variable Volume System*

Figure 4 shows a plan view layout which includes the dirt lift wheel drive. Two fluid motors, working through speed reducers, rotate the lift wheel. At 600

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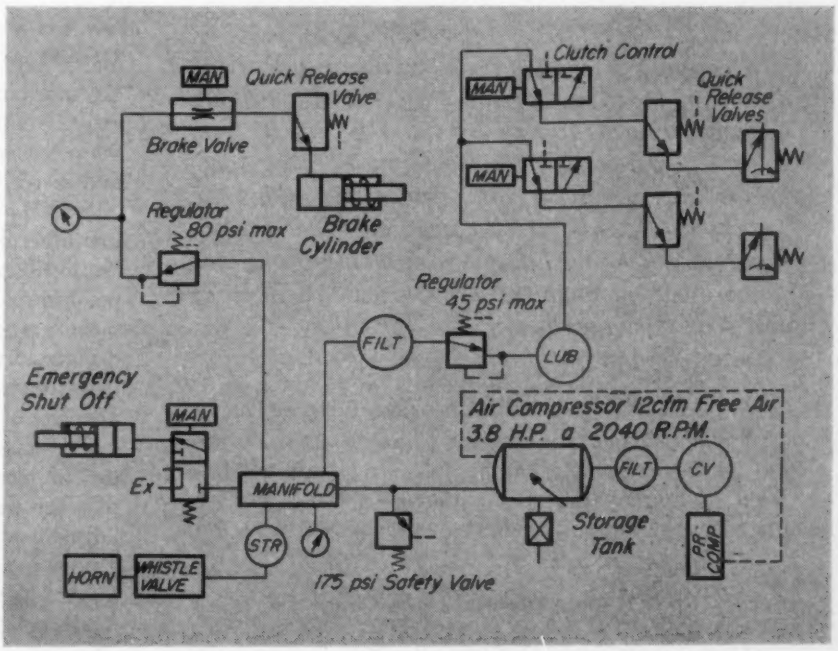
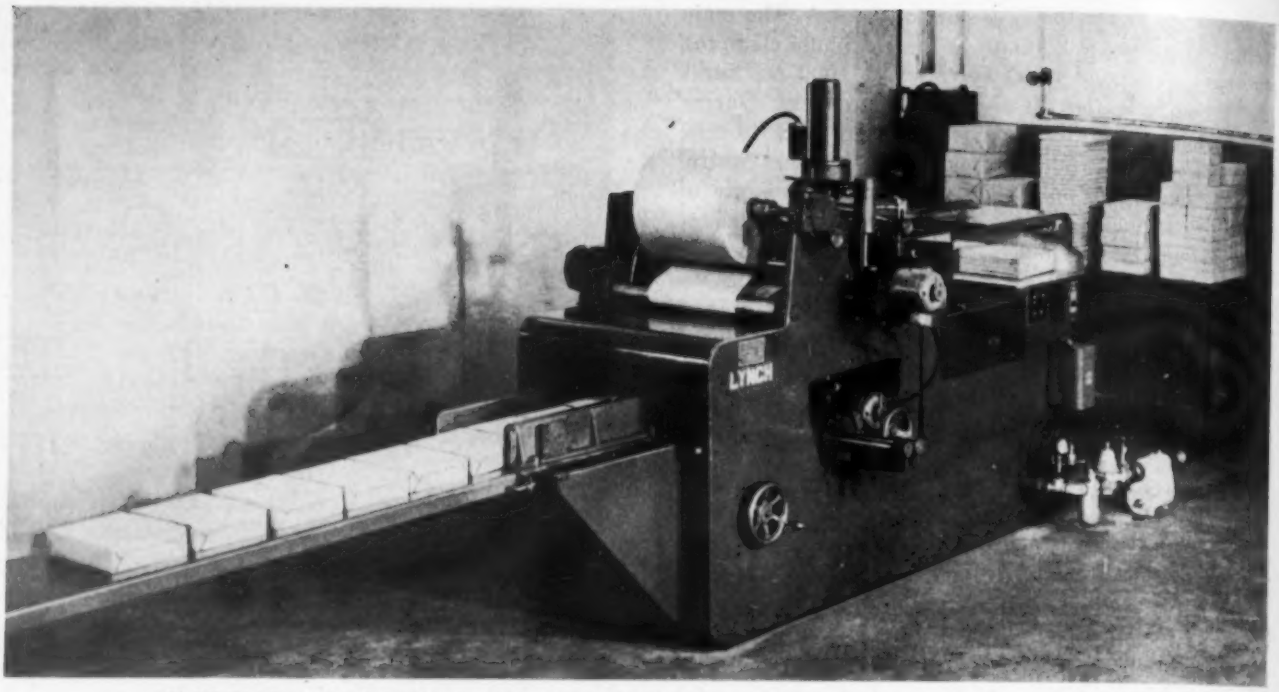



**FIG. 6. AIR is used on the ballast cleaner to operate the brake and clutch. With the storage tank full, the compressor governor reduces compressor delivery.**




ELECTRICALLY CONTROLLED AIR CIRCUITS on this packaging machine wrap and seal approximately 1000 packages per hour.

# ELECTRICALLY CONTROLLED AIR CIRCUITS improve machine operation

By R. E. Taggart

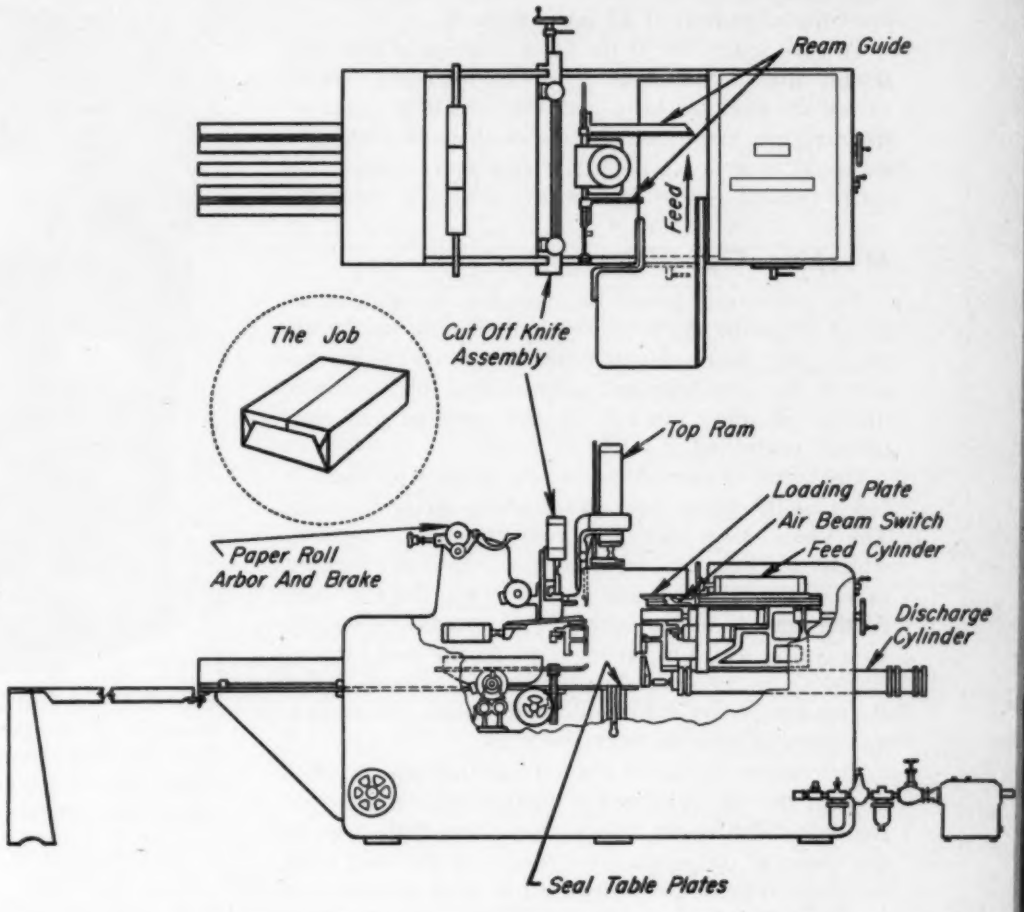
*Wrapping packages by machine requires the design of machine members to reproduce many motions. Try wrapping by hand a simple trim square package. The necessary number of operations may surprise you. And what about the time it would take you to wrap and seal several hundred such packages? Replacing your ten fingers with mechanical devices which will wrap and seal packages better and far faster is a fascinating design problem.*

WRAPPING and sealing packages of ream paper, pads, books and similarly shaped products are the most common packaging jobs. In plants where a 1000 or more packages an hour is a daily average, machine wrapping saves labor, material and time. For many years wrapping machines for this work were all mechanically actuated with many cams, gears, ratchets and fingers working from motor drives. In many cases these machines were difficult to maintain and were complicated to build.

Back in 1948, the Lynch Corporation took over the manufacturing rights of an air powered wrapping and sealing machine, and went to work to redesign the machine to make it more versatile, easier to operate and more rugged and serviceable. The result of this redesign is the Morpac Series E. Design features are illustrated in the accompanying diagrams and photographs.

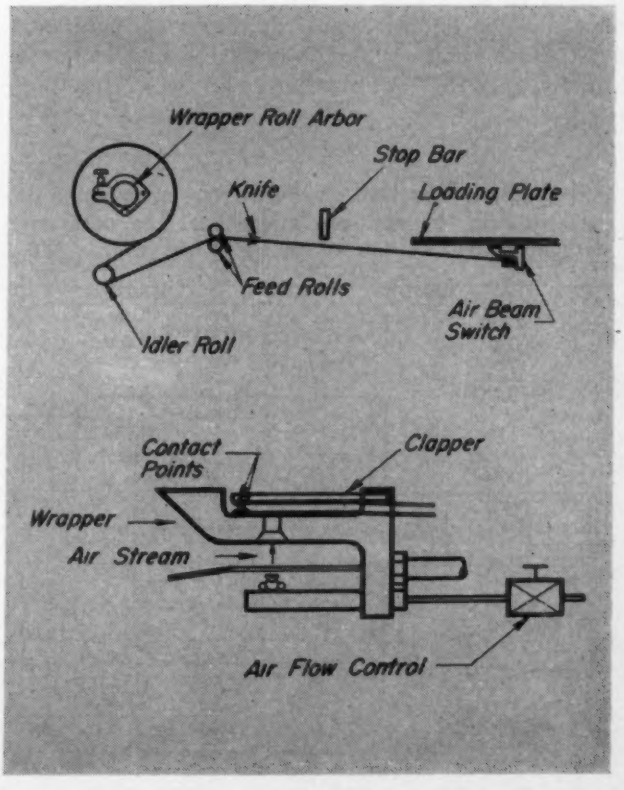
The use of air power has many advantages over the use of mechanically driven designs. Compressing the package with air results in a tight wrap. Also by simple adjustments, package size is easily varied. On the Model E a size changeover from the minimum size of 5½ x 7½ x ¾ inch to the maximum 10 x 15 x 5 can be made in less than 15 minutes. Motion of fourteen air

*R. E. TAGGART, Chief Engineer, Lynch Corporation, Toledo, Ohio.*




LAYOUT DRAWINGS of the machine show the compact design accomplished with air cylinder actuation. The ream to be wrapped is placed in the machine at the loading level and is then moved and lowered to the wrapping level. While being wrapped, the correct length of wrapper for the next package is fed out and cut off at the upper level ready to take the next ream as the finished ream is discharged.

LENGTH OF WRAPPER unrolled from the wrapper arbor is regulated by actuation of the air beam switch. The wrapper is fed around the idler roll, through the feed rolls, through the wrapper guides of the knife assembly, under the stop bar, across the well, under the loading plate and into the air beam switch. The wrapper moving into the switch cuts the air stream letting the clapper fall to deenergize the timer circuit which controls the wrapper feed.




cylinders on the machine is controlled by eight double solenoid, momentary energized 4-way valves. Wrapping and sealing is entirely automatic from load to discharge. Movement of the work or movement of a machine member trips electrical switches to maintain the automatic sequence.

## Construction Details

At top production, the machine goes through a complete cycle in about 4 seconds. With 14 cylinders moving in this short interval, a very rugged frame must be designed to prevent vibration and eventual

misalignment. A cast iron frame was designed to give precision alignment of all internal parts.

To save space and at the same time get a rigid assembly with a minimum of piping, all eight control valves are mounted on a manifold across the rear of the machine. Electrical controls are located above the manifold to greatly simplify wiring and to make the entire control system readily accessible for servicing.

## Machine Operation

Air pressure to power the cylinders is regulated at about 60 psi by the pressure regulator unit on the air supply line. Sixty cfm of actual air at 60 psi are required. The glue belts and wrapper feed roll are motor driven; all other motions are air operated and electrically controlled.

Operation is carried out at two levels. The ream is fed in at the upper level on top of the wrapper paper. The ream closes switch 1 (see electrical diagram) which causes the seal table to raise. The feed ram then moves the ream through guides under the top ram. At the same time, the cut-off knife operates to cut the wrapper on which the ream rests. As the feed ram returns, air in the seal table cylinders is exhausted and the top ram moves down pushing the ream, its wrapper, and the seal table, to the lower level.

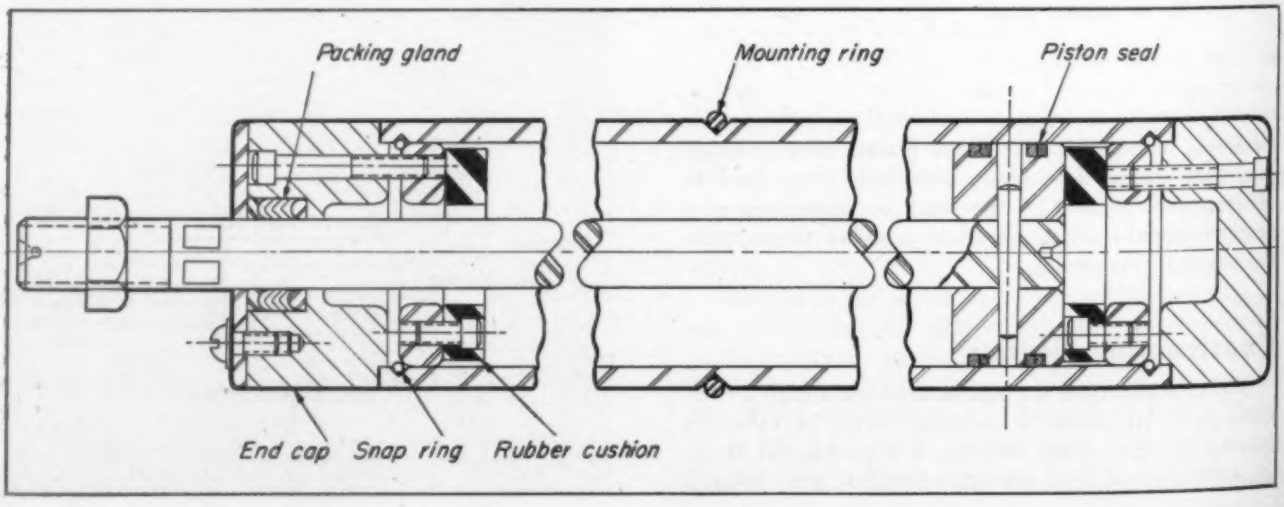
Downward motion of the top ram releases switch 4 to start the glue belt motor applying the adhesive to the wrapper. Also the wrapper feed starts to feed wrapper paper at the upper level ready for the next ream while the ream at the lower level is being wrapped.

To completely wrap the ream, the side fold plates now move in and the seal table again moves part way up to put the package under pressure. The end tuckers come in and the top seal cylinders move down. At this time, the wrapping paper being fed at the upper level breaks the air stream on switch 7 permitting the contact plate on the air beam switch to complete the circuit which energizes the wrapper solenoid and stops the wrapper feed. All member return to starting position. As the seal table goes down it contacts switch 9 and 10 to open the end seal plate and permit the discharge ram to slide the wrapped ream onto the discharge chute, where the ends are folded and sealed.

Briefly that's what happens in less than 4 seconds. Studying the electrical circuit will give you the complete details of operation and will emphasize the importance of accurate timing and sizing of the wrapper paper.

**EIGHT 4-WAY MOMENTARY solenoid air valves are mounted on a manifold at the rear of the machine. The electrical control panel and discharge ram are above the valves. The machine layout simplifies servicing of the controls and provides a compact assembly.**

**AIR CYLINDER design on the packaging machine uses a round "boss free" cylinder. Round wire snap rings are used to hold the end cap assemblies. The outer ring is used to mount the cylinder in the machine. All 14 cylinders have built-in rubber bumpers to cushion the piston travel.**



## ELECTRICAL CIRCUIT for air powered packaging machine

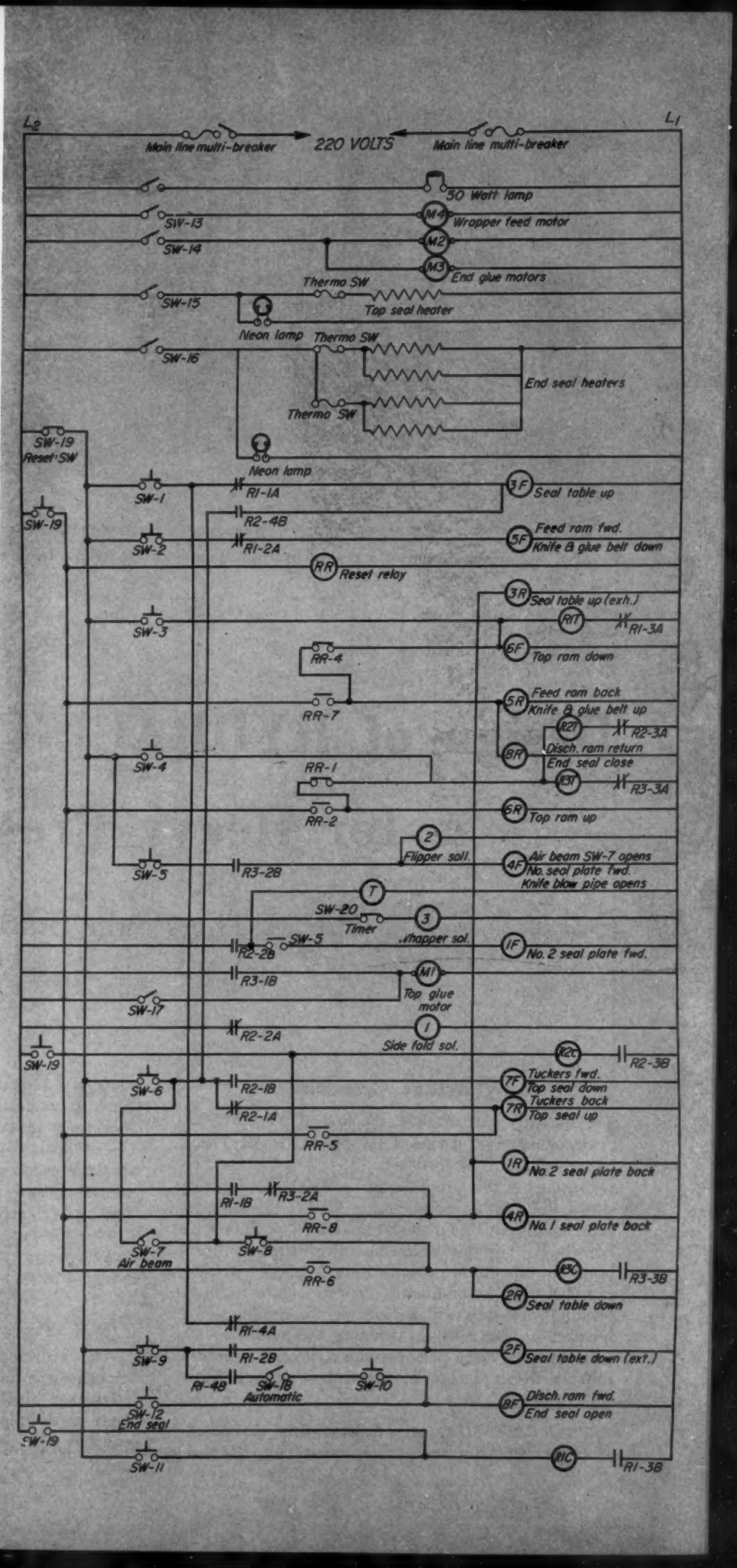
SYMBOLS

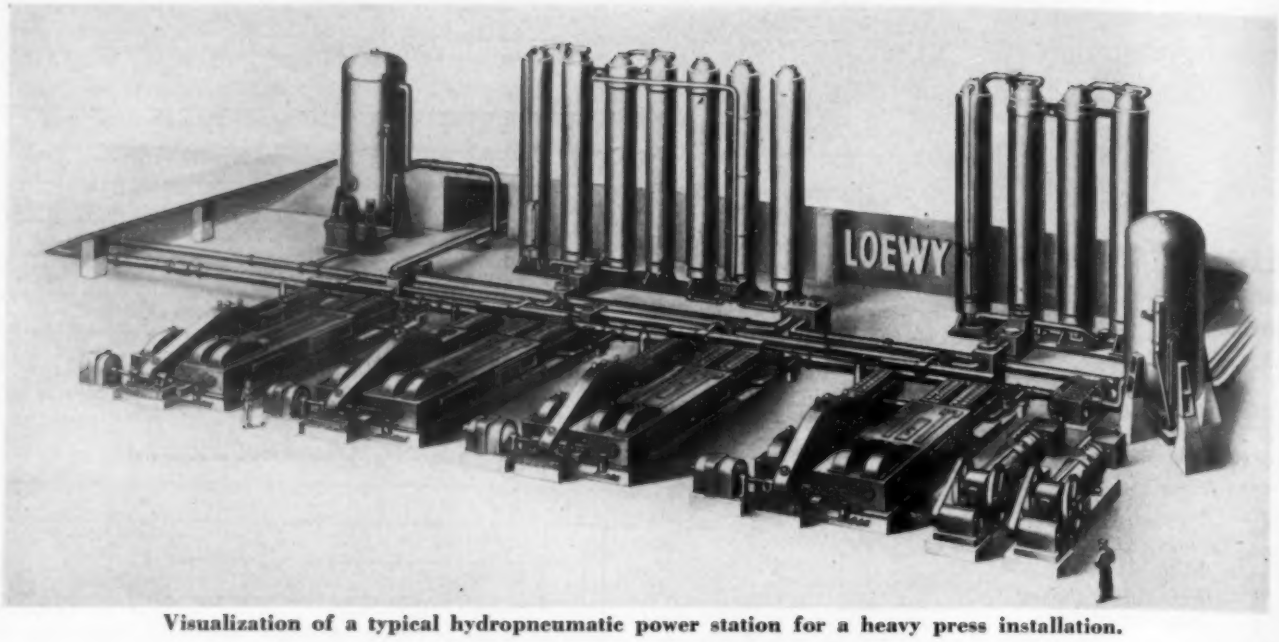
- Toggle SW
- Limit SW-Open
- Limit SW Closed
- Motor
- Solenoid
- Thermostat
- Heater
- Relay Points-Closed
- Relay Points-Open
- Sol.-Valve Front
- Sol.-Valve Rear
- Relay Sol.-Trip
- Relay Sol.-Closed
- Reset Relay Points-Closed
- Reset Relay Points-Open
- Solenoid-Reset Relay

After loading the work, the operating sequence is automatically controlled by this electrical circuit. Limit switches are tripped in sequence by movement of the work or movement of the machine members. Each of the 8 two position, 4-way valves have two solenoids. Momentarily energizing one shifts the valve in one direction where it remains until the second solenoid is momentarily energized. Use of momentarily energized valves simplifies the electrical circuit by making it unnecessary to have a great many holding relays.

Tracing the schematic diagram shows each operation which is initiated by a switch action. In case of package jam up or wrapper failure, the reset switch is closed to return the machine to its starting position. Operation of the timer solenoid controls the wrapper feed solenoid.

The end seal switch is used to open the package end sealing plate at the end of a production run to allow the removal of the last package.






**Visualization of a typical hydropneumatic power station for a heavy press installation.**

# Design of HYDRAULIC SYSTEMS for Heavy Presses

## Part I The Power Station

**By Arthur Greensite**

IN the early part of 1954, the first of the heavy hydraulic presses designed for the U. S. Air Force, are scheduled to be installed.

Included in this program, are a 50,000 ton capacity closed die forging press and a 20,000 ton capacity extrusion press; by far the largest single machine tools ever built. Together with the other presses in this program, ranging in capacity from 8,000 tons up, it is expected that revolutionary concepts in the plastic forming of metals will be introduced, resulting in a revision of many of the existing techniques in the fabrication of large machine and structural members.

While the production output of these presses will be devoted primarily to the defense effort at the present time, the utilization of heavy presses as basic machine tools in a peacetime economy will be warranted by the quality, low cost, the high production rate, of items that are produced today by costly, inefficient cutting processes, and which are metallurgically inferior to forgings or extrusions.

It is the purpose of the following discussion to acquaint the engineering profession with the hydraulic power aspects of heavy presses.

*ARTHUR GREENSITE, Design Engineer, Loewy Construction Co., Inc., New York, N. Y.*

### *The Power Station*

The hydro-pneumatic accumulator system is used exclusively in heavy press installations. The particular advantage of accumulators is their ability to satisfy large hydraulic demands for short periods. This, coupled with the use of a separate system to supply

fluid for low pressure advance stroke, affords a considerable economy, as compared with other types of power supply.

While the use of oil as the fluid medium predominates in small and medium size installations, water is almost universally used for heavy presses. Water, due to its low viscosity, permits higher pipe line velocities; is cheaper, less compressible, and eliminates fire hazard. But most important, water permits the use of smaller valves, which, in the high pressure-high capacity type encountered in heavy presses, results in considerable saving in cost and space.

Figure 1 represents a schematic arrangement of a typical accumulator system.

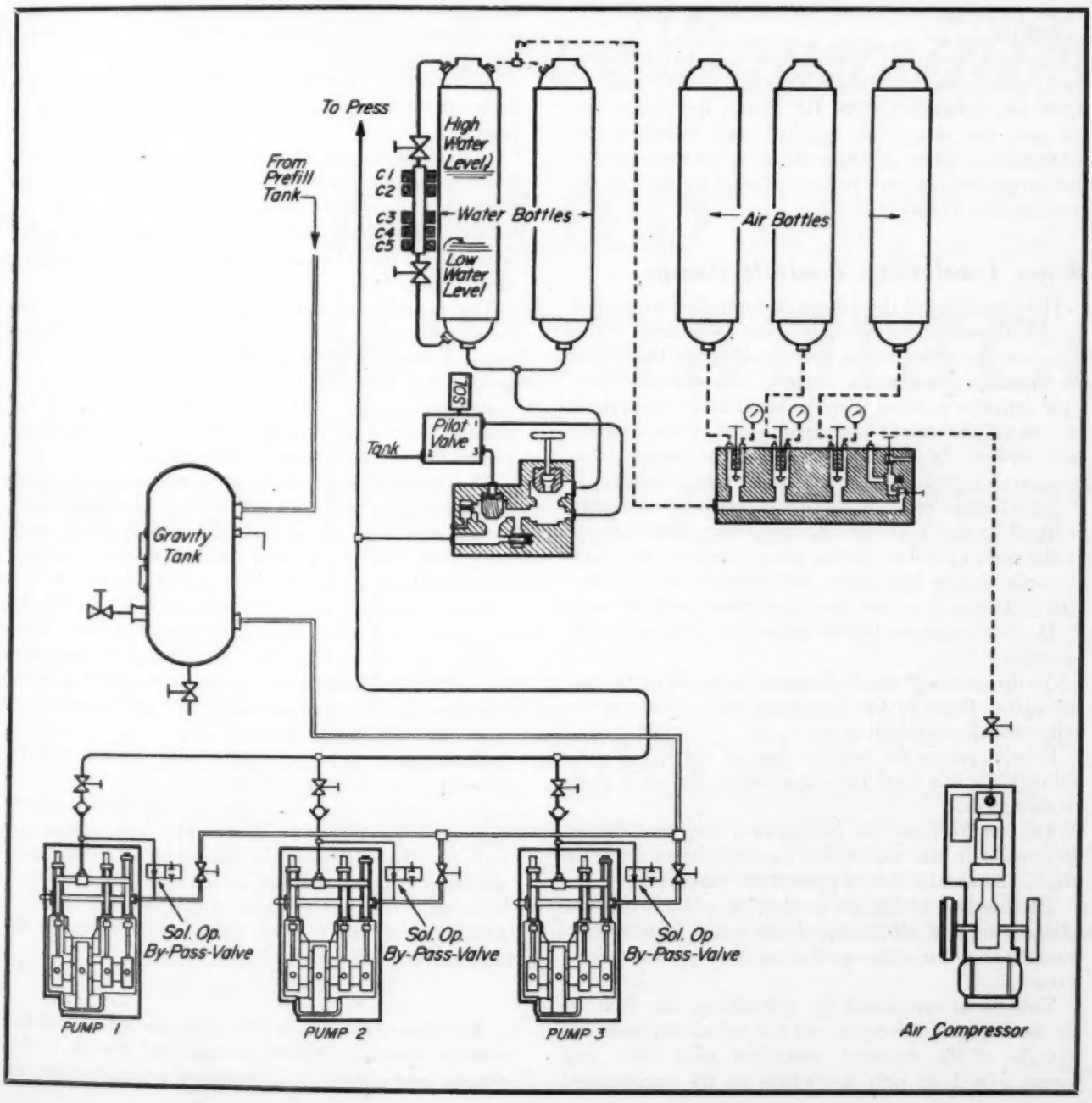
Water, under pressure, is stored in the "water bottles", by means of air charged to the required pressure and contained in separate "Air Bottles". A compressor is used to build up the air pressure initially. The size of the compressor is determined by the time allowed to charge the system. Thereafter, the pressure is maintained in the system within predetermined limits. A series of pumps restore the high pressure water to the water bottles, operating intermittently as required.

A discussion of a specific case, will add materially in clarifying the operating of the system.

For the 20,000 ton extrusion press, 5,600 gallons of water at 4,500 psi are required in 60 seconds. Total time of extrusion cycle is 240 seconds. This makes the hydraulic power station for this press the largest in the world today.

Were it required to supply 5,600 gallons at 4,500 psi

**FIG. 1. Typical hydropneumatic power station for a heavy press installation.**



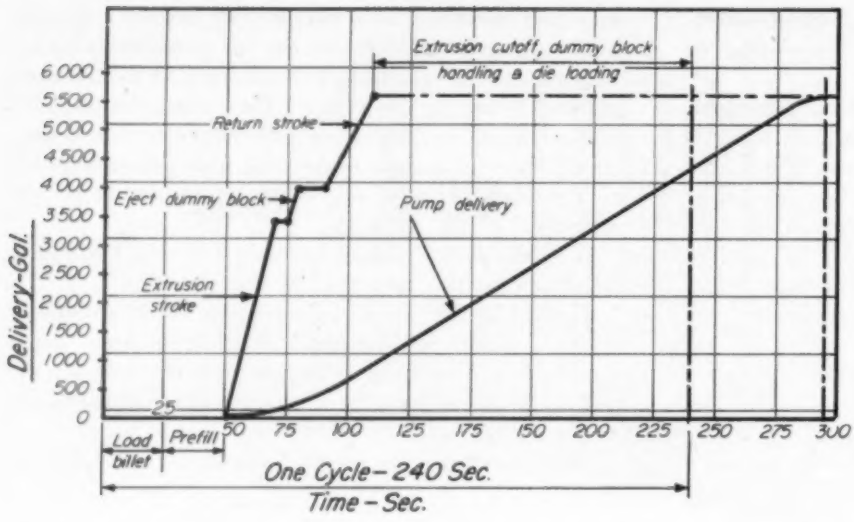



**FIG. 2. Hydraulic demand curve for a 20,000 ton extrusion press. During the 60 second press operation 5600 gallons of water at 4,500 psi are supplied by a hydropneumatic power station. Seven 233 gpm pumps, each driven by a 700 hp motor replenish the accumulator system in 240 seconds.**

in 60 seconds directly by pumps, the power capacity of the pumping unit would have to be approximately 14,700 HP.

However, with the accumulator system, utilizing seven pumps, each having a capacity of 233 gpm at 4,500 psi, driven by a 700 HP motor, the pumps are cut into the system as required and replenish the accumulator system in 240 seconds, as the accumulator discharges the required volume of working fluid in 60 seconds. See Figure 2.

## *Water Level Gage Controls Pumps*

The operation of the pumps is controlled by a level gage built into one water bottle; the water level of the gage corresponding to the water level inside the bottle. As the water level begins to drop, a float in the level gage activates a series of solenoids suitably positioned, to "cut in" the pumps and supply water to the accumulator system. In "cut out" position the pump circulates water back to tank at practically zero pressure.

As a further economy, a prefill system, (not shown in the diagram) is utilized to supply low pressure water to the main cylinders during the advance stroke which does not require high power and which is ten and one-half feet long. For four main cylinders, each 57 inch I. D., this requires 10,000 gallons at 150 psi in 25 seconds.

As the pressure stroke begins, water from the accumulator flows to the low level valve block shown schematically in the diagram.

Here, it passes the built in shut off valve, and goes through the low level valve and out to the main press control bank.

The supply from the pumps after they are cut in, is brought to the main press lines as shown. Suitable check and shutoff valves protect the pump lines.

The function of the low level valve, as the name implies, is to shut off the supply of water from the accumulator as the water level drops to a predetermined value.

This is accomplished by permitting the float in the level gage to energize coil C4, which activates the spindle of the solenoid controlled pilot valve and opens port 1 to port 3, (which in the unenergized position blocks port 1 and opens 2 to 3) thereby closing the low level valve. The supply from the pumps may enter through the check valve for replenishing the accumulator.

As a further protection for the system, the coil C1 shuts off the pump power when the high level mark is reached.

For simplicity, the diagram shows 3 air bottles and 2 water bottles. However, in the installation on the 20,000-ton extrusion press discussed above, 25 air bottles and 4 water bottles are used. Each bottle is 52 feet high 66 inch O.D. and 7 inch wall, with a capacity of 350 cubic feet.

The capacity of the station is determined by the volume of water used per cycle and the permissible pressure drop. With a usable water volume of 5,600 gallons and allowing a 10 per cent pressure drop, a polytropic expansion of the air with coefficient of expansion $n = 1.35$ results in the required initial air volume of approximately 70,000 gallons.

The accumulator bottles are constructed of multi-layer laminations welded radially and longitudinally; forged steel caps at the ends are welded to the main body shell. The design and fabrication must conform with applicable codes and state and local laws.

It is mandatory in installations of this size, for the system to "fail safe". That is, in the event of an inoperative control or improper functioning of any unit, the system will shut down in such a way that a specified pressure is never exceeded, nor air permitted to enter the main water lines.

The design of such circuits and devices will be covered in a separate article.

It is obvious that the capacity of hydraulic power stations is practically unlimited. The basic design and control circuit discussed in this article is adaptable to almost any capacity. It has a long and enviable record of trouble free performance which accounts for the popularity of this type of system with hydraulic designers.

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*Subsequent articles in this series will discuss valves, control diagrams, safety circuits and design of hydraulic components used in heavy press installations.*

# Announcing the Award Winners in the 1953 APPLIED HYDRAULICS PRIZE PAPER CONTEST

● Winning papers describe machine and component design, production methods and maintenance techniques in the Fluid Power Field. Since the first announcement of the contest last November, over 50 papers were submitted to the judges. Each paper was individually evaluated on the basis of its practicality, its economic value, originality and presentation. Judges for the contest were Dean M. Cleaveland, Plant Lubrication Engineer, Bendix Products Division, Bendix Aviation Corporation, Walter Ernst, Vice President and Director of Engineering, The Commonwealth Engineering Company of Ohio, and J. R. Hemeon, Hydraulic Equipment Engineer, Ternstedt Division, General Motors Corporation.

# 1953 Award Winners in the APPLIED HYDRAULICS PRIZE PAPER CONTEST

## FIRST PRIZE $500

**Frank C. Lornitzo,** Pantex Mfg. Corp., Pawtucket, R. I. **"New Hydro-Air Power Unit Offers More Speed, Force and Control."**

Complete analysis of the development steps, design, application and advantages of a power unit which combines hydraulic and pneumatic cylinders.

## SECOND PRIZE $300

**Charles G. Spicer and Thomas Baxter,**

Leland Electric Canada Ltd., Guelph, Ontario
**"How Air Powered Shop Tooling Solves a Motor Assembly Problem"**

Design of a special electrically actuated pneumatic machine used to insert and cut off copper bars in rotors of fractional horsepower motors.

## THIRD PRIZE $200

**C. E. Bowman,** University of Illinois, Urbana, Illinois

**"Design of a Hydraulically Operated Biaxial Testing Machine"**

Development of a testing machine which helps determine material fatigue properties by applying a regulated load to a test specimen at a rate of 100 to 200 cycles per second.

Three prize winning papers are published on the following pages. Each offers a practical application of fluid power to the design of plant tooling or to a complete machine. In succeeding issues other prize winning papers will be presented.

## 4th through 7th PRIZES $50 Each

**John M. Klover,** John Hopkins University, Silver Springs, Md. "Hydraulic and Electrical Circuits for a Broaching Fixture"

This broaching fixture is in use in a major plant making automotive parts. The electrically controlled hydraulic circuit is applied to the fixture which stretches the work piece to size, while holding it during a broaching operation. Design of a three pressure hydraulic circuit is shown.

**Edward L. Bronstein, Jr.** and **Richard A. Fisher,** United States Bedding Co., St. Paul, Minn., "Electro-Pneumatic Wire Forming Machine"

Here's a solution to spring forming problems. The paper details an in-plant application of air power which produces 100,000 unusual hexagonal wire springs per day. Straightening, and cutting of 13 gauge hard spring wire, forming of the spring and joining of loose ends to form a continuous spring are accomplished during an automatic cycle.

**Leroy R. Conklin,** The Taylor Winfield Corp., Warren, O. "Air-Hydraulic Circuit of an Electric Resistance Seam Welder"

Discussion of changes made to the air-hydraulic system of a resistance seam welder which have taken place over a period of 15 years. Machine layout drawings, detailed drawings of the power cylinders, and the electrical and air-hydraulic circuits show the stages of improvement. Circuit changes were made to meet changing speed and travel requirements.

**C. R. Sacchini,** Marquette Metal Products, Co., Cleveland, O. "Hydraulically Operated Windshield Wiper for Aircraft"

Flow diagrams and cutaway photographs illustrate the design and operation of hydraulic valving on a wiper developed for use in commercial and military aircraft. A fluid motor actuator unit is arranged to divert pressure fluid alternately to opposite ends of a closed loop servomechanism.

## HONORABLE MENTION

**J. H. Dotter,** Bethlehem Steel Co., Sparrows Point, Md., "Applications and Maintenance of Hydraulic Valves" • **G. H. Salzano,** Vitro Corp., Bayonne, N. J., "Modifications to Existing Standard Sheet Metal Baling Machine" • **R. W. Hoyt,** Double Seal Ring Co., Fort Worth, Texas, "Hydraulic and Pneumatic Test Stand for Piston Rings" • **James Tankard,** Zagar Tool, Inc., Cleveland, O., "A Pictorial Presentation of the Differential Circuit, Fast Return Stroke Cycling" • **Wm. E. Darby,** Canadian General Electric Co. Ltd., Peterboro, Ontario, "Hydraulically Operated Indexing Machine for Rotor Rim Plates" • **Norton Williams,** Vickers, Inc., Detroit, Mich., "An Example of a Hydraulic Servomechanism" • **Gerald L. Rogers,** Stile-Craft Mfg. Co., St. Louis, Mo., "Design of a Pneumatic Open-Sided Ratchet Wrench" • **Wm. F. Morgan,** National Acme Co., "Circuit for a Single Purpose Machine Tool".

First Prize

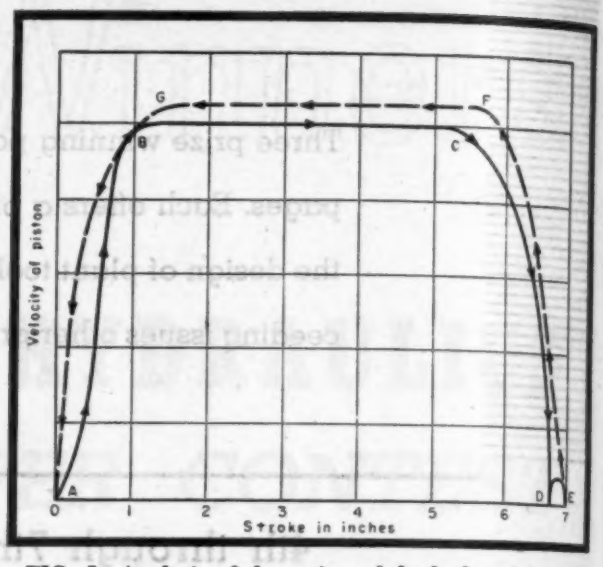



**FIG. 1. Analysis of the action of the hydro-air power unit showing forward and return velocities.**

# New Hydro-Air Power Unit

## OFFERS MORE SPEED, FORCE AND CONTROL

**By Frank C. Lornitzo**

HYDRAULIC and pneumatic cylinders have been combined into a compact power package that delivers a sequence of piston actions not before available in a unit so small and so efficient. Not only does it deliver the actions required in garment press operation, for which it was originally designed, but it offers such flexibilities in speeds, pressures and movements that it promises widespread application in the entire machine design field.

These unusual piston actions include fast, unhampered opening and closing strokes, positive and consistent retardation at the end of each stroke and the delivery upon demand of more than a ton of force, all at a total expenditure of less than 0.11 cu. ft. of air. It occupies less than one cu. ft. of space and weighs about 15 lbs.

An approximate analysis of the action of this hydro-air power unit, as applied to a garment press, is plotted on the graph in Figure 1. Maximum stroke is fixed at 7 in., but velocity of the piston stroke depends on air pressure. Initial acceleration (A-B) is high, mid-stroke velocity (B-C) is essentially constant and deceleration at approach to full extension starts at C, about three-quarters of piston travel. The power stroke, represented as (D-E), can be applied upon demand after initial opening action is stopped. Piston return requires an external force, such as a spring, but movement is controlled to follow a sequence similar to the opening stroke. Final deceleration starts at G, approximately the ¾-point of the return stroke.

Practicality of the new power unit has been proved by its successful application to a new air-powered garment press. Hundreds of these new presses are in daily service and because of the economy and versatility of the power supply many commercial garment processing plants have converted from relatively new presses of conventional design to the new hydro-air press.

This power unit permits the realization of the ideal garment press design in which hydraulic power can be developed and controlled to produce the action of a manually powered machine. In fact, the new unit has desirable performance characteristics which were previously considered unobtainable.

Garment press manufacturing history contains several previous attempts to build machines that simulate the action of the foot operated press. The complicated

## : STAGES OF DEVELOPMENT :

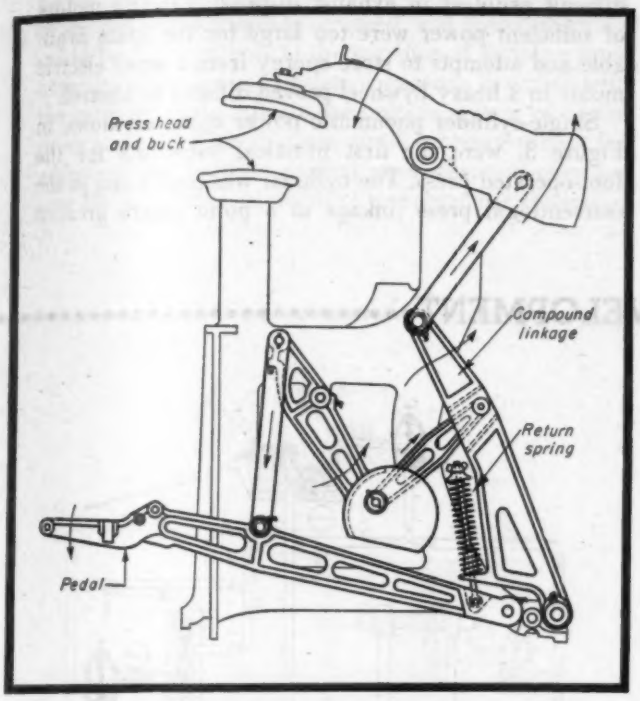



**FIG. 2. Complicated toggle linkage of a foot operated fully mechanical press.**

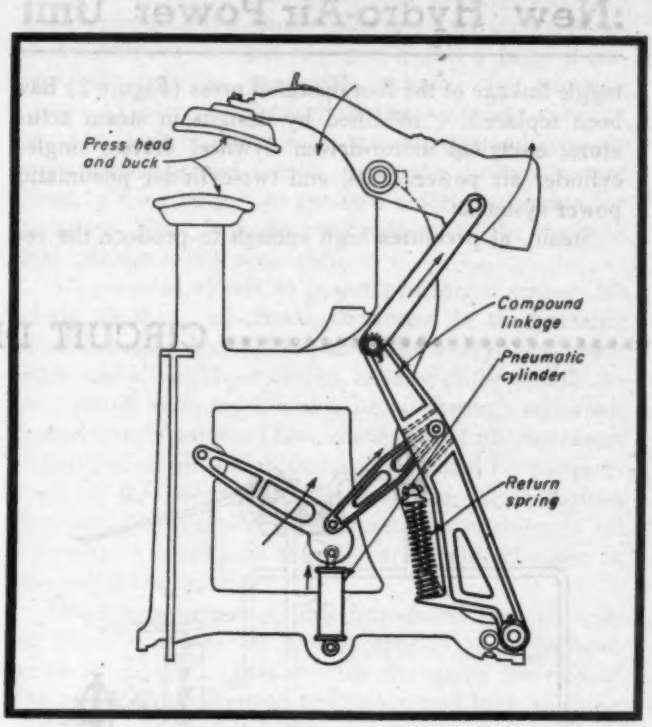



**FIG. 3. Single cylinder pneumatic power unit does not give consistent pressure.**

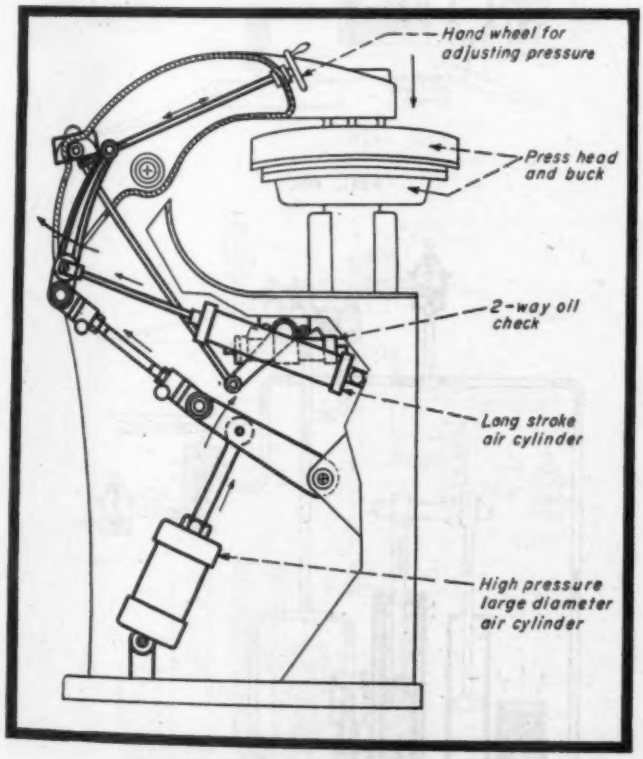

Hand wheel for adjusting pressure
Press head and buck
2-way oil check
Long stroke air cylinder
High pressure large diameter air cylinder

**FIG. 4. Two pneumatic cylinders are used. Frequent readjustment of the mechanical linkage is required.**

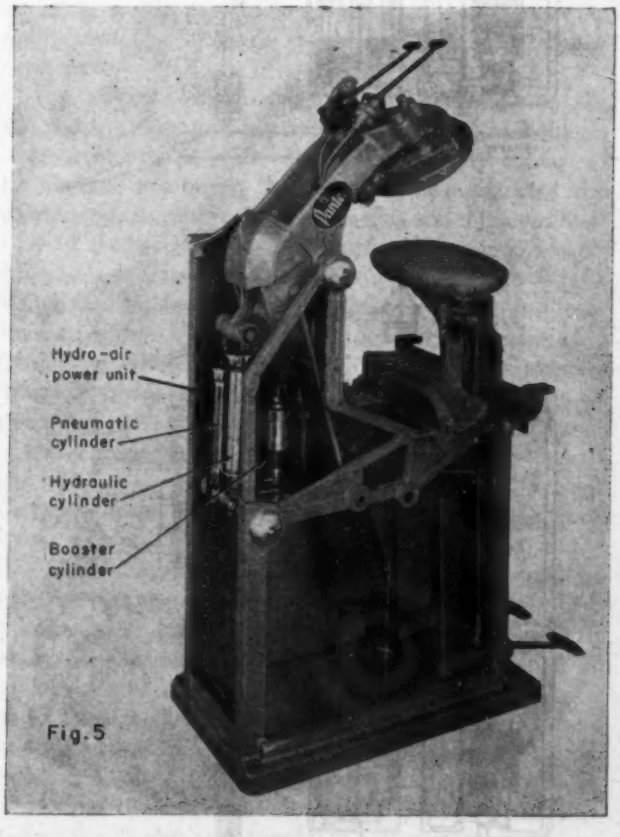



**FIG. 5. Design of the press incorporating the hydro-air cylinders overcomes the shortcomings of previous machines.**

## :New Hydro-Air Power Unit

toggle linkage of the foot operated press (Figure 2) has been replaced or modified by designs in steam actuators, electrical motor-driven flywheel drives, single-cylinder air power units, and two-cylinder pneumatic power systems.

Steam, at pressures high enough to produce the required action, was costly to operate and presented a difficult problem in exhaust disposal. Electric motors of sufficient power were too large for the space available and attempts to store energy from a small electric motor in a heavy flywheel proved difficult to control.

Single-cylinder pneumatic power units, as shown in Figure 3, were the first practical substitute for the foot-operated press. The cylinder was positioned in the conventional press linkage at a point where greatest

## CIRCUIT DEVELOPMENT

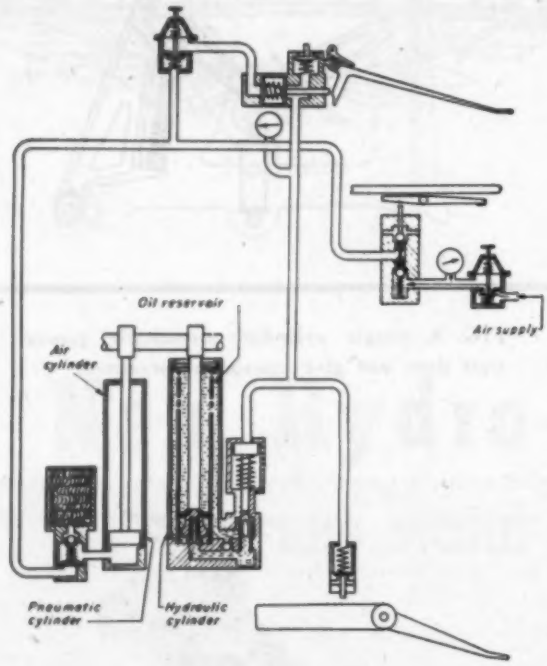



FIG. 6a.

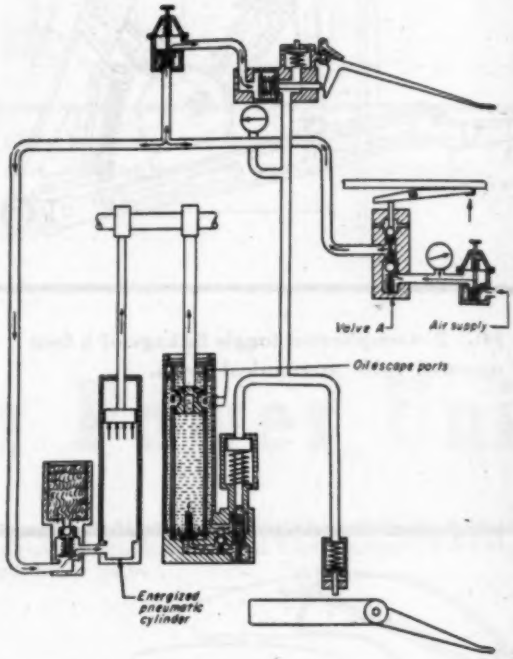



FIG. 6b.

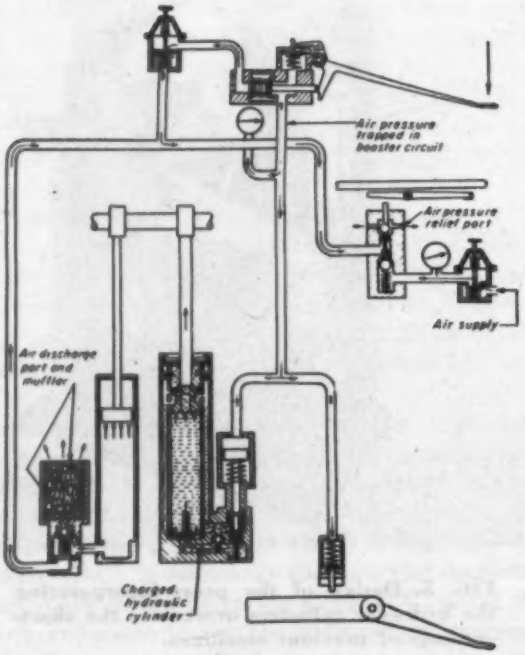

Air pressure trapped in booster circuit
Air pressure relief port
Air supply
Air discharge port and muffler
Charged hydraulic cylinder

FIG. 6d.

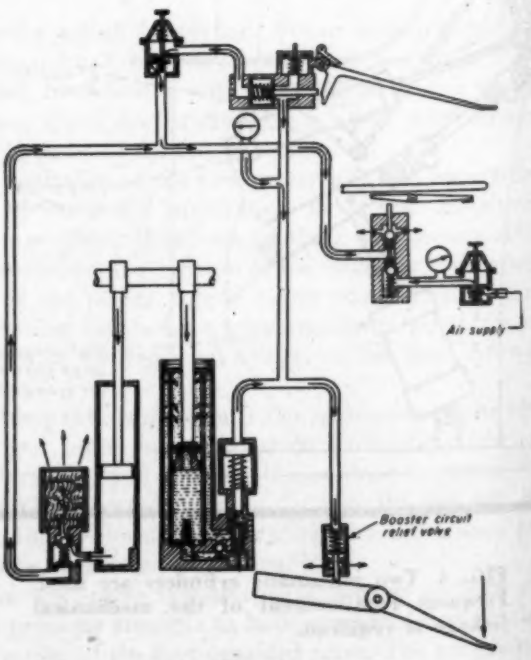



FIG. 6e.

mechanical advantage could be derived from the thrust of the air piston. However, working pressure was developed at the sacrifice of speed, and speed of action could be obtained only at the sacrifice of working pressure. Pressure is not consistent because it varies with the position of the bars in the linkage system when the press is closed. This requires auxiliary mechanisms for adjusting the machine desired pressures, and compensate for variations in padding and garment thickness.

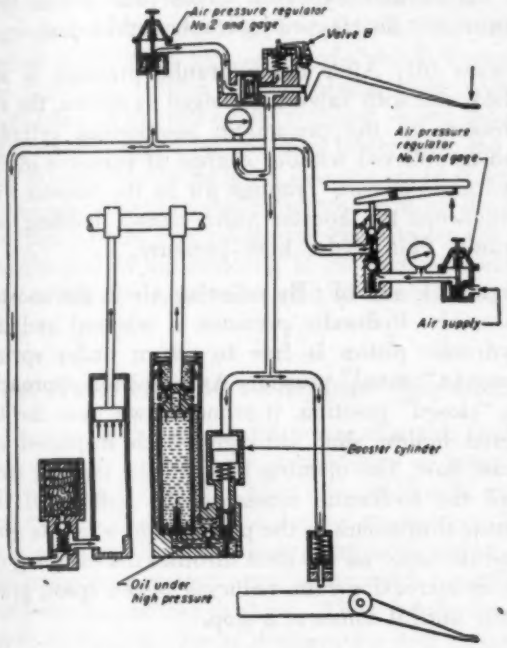

Air pressure regulator No. 2 and gage
Valve B
Air pressure regulator No. 1 and gage
Air supply
Booster cylinder
Oil under high pressure

FIG. 6e.

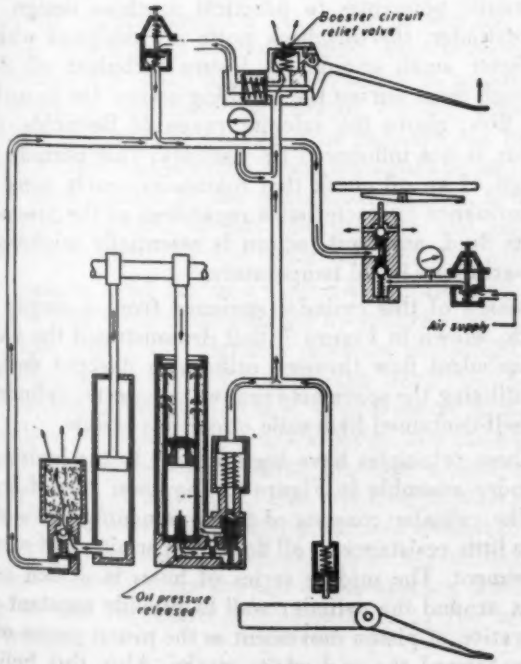



FIG. 6f.

The next practical design in the development of a power press used a small diameter, long stroke pneumatic cylinder for fast movement, and a large diameter, short stroke pneumatic cylinder for pressing power (Figure 4). Because the larger power cylinder must be limited in size, to fit the machine and keep air consumption within reason, a complex linkage system must be used with it to produce a force adequate for pressing. Thus, frequent readjustment of the mechanical linkage is still required.

All previous efforts to power pressing machines include auxiliary oil checks connected to the pressing head linkage to prevent impact as the heavy press heads open and close. These checks, usually of the double action piston type, force hydraulic oil through screw-adjusted needle valves. These checks resist all movement regardless of the action desired, and must be overpowered by the pneumatic cylinders. The valves require frequent adjustment to compensate for changes in oil viscosity. Viscosity of the oil varies with changes in operating temperature.

The hydro-air power unit introduced here consists of three cylinders, as shown applied to a garment press in Figure 5, that provide the speed for closing the press, reduced speed at closing, and high working pressure without using excessive amounts of air. In a garment press, the unit needs no mechanical amplification of force through a toggle linkage, because it exerts enough force to permit the use of a simple first class lever for the pressing arm. This press design will repeat adjusted pressures throughout a full range of pressing positions. No readjustment is necessary to compensate for changes in garment thickness or padding wear.

The advance in garment press design which the hydro-air power unit represents is outlined in Table 1.

Interest expressed by designers of many classes of production machinery has already demonstrated the existence in industry of broad needs for this combination of fast action, damped terminal stopping, powerful finish and full reversibility. For example, it is now being studied for possible application to a wood laminating press. The entire field of press design (for laminating, powder metallurgy, metal forming, plastics molding, metal straightening) can find new mechanical potentials in this stroke characteristic.

Obviously, details of the design can be altered to produce many variations in the sequence of action. To mention a few possible modifications, length of stroke can be changed, hydraulic force varied, duration and intensity of checking action rearranged to suit the function required. Because of that versatility, it seems clear that the design offers real usefulness in many applications yet unidentified.

Considering the power unit as a separate unit, two of its three cylinders are mounted together, with their housings anchored on a common shaft, and their piston rods attached to a movable pivot shaft. The cylinder of smaller diameter functions pneumatically and furnishes the power and speed for fast piston extension. Its companion cylinder is a hydraulic power cylinder that retards motion at the end of the extension stroke

# :New Hydro-Air Power Unit

and furnishes the power for the eventual working pressure when required.

The third cylinder, attached to the hydraulic cylinder, serves as a booster. It contains a differential piston that converts air pressure at 80 lbs. per square inch to hydraulic pressure of approximately 1015 lbs. per square inch, and controls the delivery of high-pressure oil to the hydraulic power cylinder.

Connected to a compressed air system supplying air at 80 lbs. per square inch, and equipped with appropriate valving, as presented in the diagrams of Figure 6, the hydro-air unit functions as follows:

Figure 6A: The power unit is at rest and the pistons are at closed position. The shaded area of the hydraulic cylinder shows the hydraulic oil in this self-contained hydraulic system. The cylinder has a double casing. The spacing between the concentric sleeves serves as a reservoir and storage tank for the hydraulic oil. With the piston at "down" position, the reservoir is full of oil because the piston rod is displacing its maximum volume.

Figure 6B: With air entering the system at valve A, the pneumatic cylinder is energized, its piston moves out and takes the piston of the hydraulic cylinder with it. Displaced oil from the hydraulic cylinder unloads through large ports in the cylinder wall into the surrounding reservoir. Toward the end of its stroke, the piston passes through the section of this cylinder where the oil escape ports are located, and gradually reduces the number of escape ports for the confined oil. Back pressure on the piston gradually increases as successive holes are closed, and piston movement is gradually stopped. The expanding volume below the piston is filled with oil that flows from the reservoir through passages as indicated by the arrows.

Figure 6C: After the pistons are positioned and their movement is stopped, hydraulic pressure is applied by air pressure admitted through valve B to the booster cylinder. The differential piston in the booster cylinder increases pressure at a 12.25 to 1 ratio, producing a hydraulic pressure of about 1015 lbs. per square inch in the hydraulic cylinder. The stem of the pneumatic piston closes the port to the tubular hydraulic piston and forces that piston into the trapped hydraulic fluid below.

Figure 6D: After the hydraulic pressure is applied, and with valving arranged as shown, the air pressure to the pneumatic positioning cylinder can be relieved without change of pressure in the hydraulic circuit. Trapped air in the booster circuit keeps the booster valve closed, holding hydraulic fluid under high pressure.

Figure 6E and 6F: By relieving air in the booster assembly, hydraulic pressure is released and the hydraulic piston is free to return under spring force to "closed" position. As the piston approaches "closed" position, it comes down over the tapered hollow stem through which displaced oil must flow. The opening between the tapered stem and the hydraulic recess in the bottom of the piston diminishes as the piston approaches its seat, and the taper on the stem throttles the escaping oil at an increasing rate, reducing piston speed gradually until it comes to a stop.

**TABLE I**

| Hydro-air powered press | Air and linkage powered press |
|---|---|
| 1. Single first class lever | 1. Complex mechanical linkage required |
| 2. Self-adjusting; total force is directly proportional to air pressure | 2. Leverage requires adjustment for changes in garment and padding thickness |
| 3. Oil check is integral with hydraulic unit and needs no adjustment | 3. Oil check separate unit and requires two adjustments |
| 4. Checking action only at extreme ends of stroke permits unimpeded travel | 4. Checking action, continuous through full stroke, must be over-powered |
| 5. Two air cylinders with total displacement of about 30 cu in. | 5. One or more air cylinders with minimum displacement of 60 cu in. |
| 6. Space saved can be utilized for air compressor | 6. All space in machine frame occupied by mechanism |
| 7. Common pivot for all power components | 7. Individual mounting points for each cylinder and the oil check |
| 8. Unit easily removed and serviced at a bench | 8. Difficult to service; components not easily accessible |
| 9. Pressing arm may be stopped at any point in travel | 9. Not possible |
| 10. More machines can be operated on a given amount of compressed air | 10. Relatively large air supply required |

The key member of this hydro-air power system is the special hydraulic cylinder which represents a significant advance in the art of applying established hydraulic principles to practical machine design. In the cylinder, the oil check ports are designed with a diameter small enough to insure turbulent oil flow through them during the checking action. Oil in turbulent flow, above the velocity range of Reynolds' criterion, is not influenced by viscosity. This permits the design of an oil check that maintains nearly constant performance characteristics regardless of the viscosity of its fluid, and thus, action is essentially unchanged by variations in oil temperature.

Design of this cylinder stemmed from a simple oil check, shown in Figure 7, that demonstrated the value of turbulent flow through orifices in dashpot design. By utilizing the space between two concentric cylinders, the self-contained hydraulic circuit is possible.

These principles have been applied to the hydraulic cylinder assembly in Figure 8. The lower row of holes on the cylinder consists of large unloading holes that offer little resistance to oil flow and permit rapid piston movement. The middle series of holes is drilled in a helix around the cylinder wall to provide constant deceleration of piston movement as the piston passes over them toward the end of its stroke. Also, this helical placement of the holes insures that oil flow from the

cylinder to the reservoir housing will be evenly distributed around the periphery of the housing, preventing a build-up of hydraulic fluid on one side of the reservoir. The third series of holes at the top of the cylinder is drilled in a ring around the cylinder; they enter the wall at an angle to direct escaping oil down into the reservoir. The second and third series of holes are of a diameter small enough to insure turbulent flow of oil through them during the checking action. By maintaining turbulent flow through the orifices, the checking action does not change with the viscosity of the hydraulic oil, which may vary with temperature. No adjustments are required in this design.

The truncated configuration of the piston head is necessary in this design to prevent cavitation at the beginning of the downward stroke. At the fully extended position of the piston, the small diameter of the truncated section in the piston head spans the large holes at the top of the cylinder. When the downward stroke begins, oil will pass freely from the reservoir through the large holes into the relief around the piston, past the ring-shaped check valve on the piston rod, and into the evacuated chamber between the piston and the end of the cylinder. If oil were not permitted to pass into the chamber, return speed would be hampered.

### *Two Valves Give Complete Regulation*

Because of the speed and power that this hydro-air unit delivers at minimum expenditure of compressed air, the complex linkage long associated with garment pressing machinery is no longer necessary; it now becomes possible to use a straight lever action which will maintain constant working pressure regardless of variations in padding thickness. Thus, for the first time, speed of closing, rate of deceleration and intensity of working pressure can all be regulated and indicated accurately merely by adjusting two air regulators.

In the circuits in Figure 6, one air regulator on the main air supply regulates the speed of opening and closing action, but does not affect the decelerating characteristics of the hydraulic cylinder. A second air regulator is positioned to control the air pressure directed to the booster valve. This pressure can be reduced to zero and working pressures would be no more than those exerted by the pneumatic cylinder, or they could be increased to full line pressure and impose full effectiveness on the hydraulic booster circuit.

Practicality of the new hydro-air power unit has been conclusively demonstrated by its growing use as a prime mover for garment pressing equipment. Its contribution to the machine design field lies in the mechanical simplification and improvement it makes possible. Simplicity of the unit's design and the nature of the motion produced make the unit adaptable to many types of machines. The threaded tubular construction permits a flexibility in size and motion to suit nearly all pressing requirements. The mechanism for smoothly decelerating the end of the opening and closing strokes represents a contribution to the art of hydraulics.

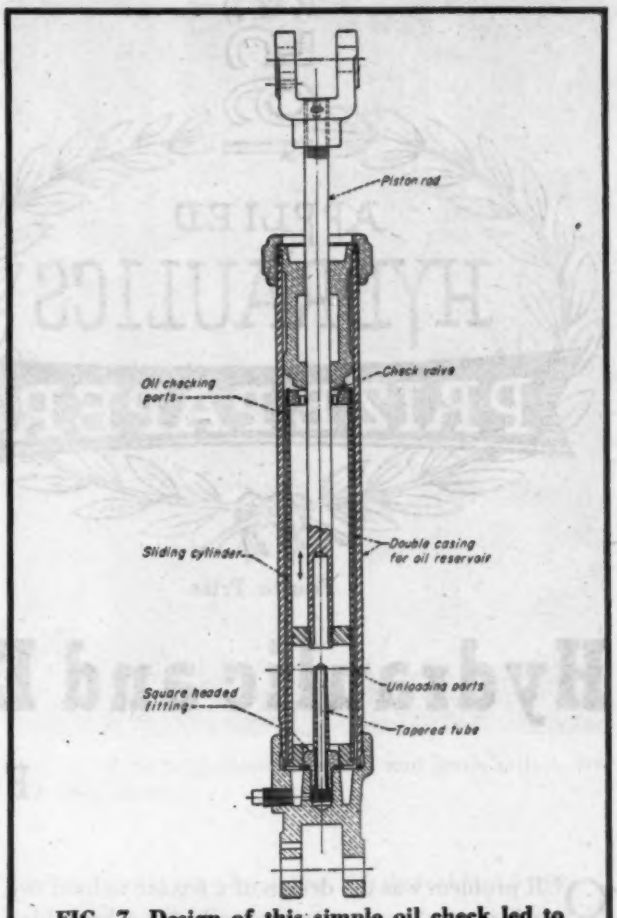
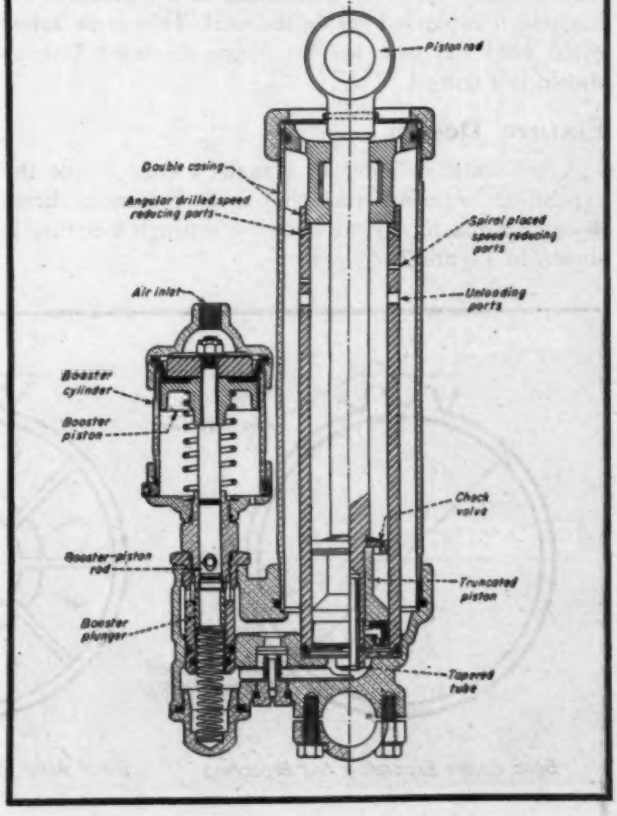



**FIG. 7. Design of this simple oil check led to the development of . . .**

**FIG. 8. . . . the hydraulic cylinder and booster cylinder used in the hydro-air power unit.**



1953

APPLIED HYDRAULICS PRIZE PAPER

Fourth Prize

By John M. Klover

# Hydraulic and Electrical Circuits

## FOR A BROACHING MACHINE

OUR problem was the design of a fixture to hold two welded steel transmission bands for a broaching operation and with no extra handling to stretch them to size.

Previous production experience indicated the stretching operation could be performed on a segmented arbor which expanded inside the part. This same arbor could hold the part for broaching its front face as shown in Figure 1.

### Fixture Design

A hydraulic cylinder to actuate a cone inside the expanding segments was chosen as the most direct design approach. A sectional view through a fixture is shown in Figure 2.

### Hydraulic Pressures

Analysis and laboratory tests showed a pressure of 2800 pounds per square inch acting on the rod end of the piston, Figure 2, would effectively expand the part. Further tests showed it was possible to drop this pressure to 800 pounds per square inch for clamping during the broaching operation. It was also determined that 80 pounds per square inch pressure on the lower end of the piston was the maximum required for unclamping.

### Broaching Machine

A vertical, two ram broaching machine with sliding work tables was selected. The work tables being

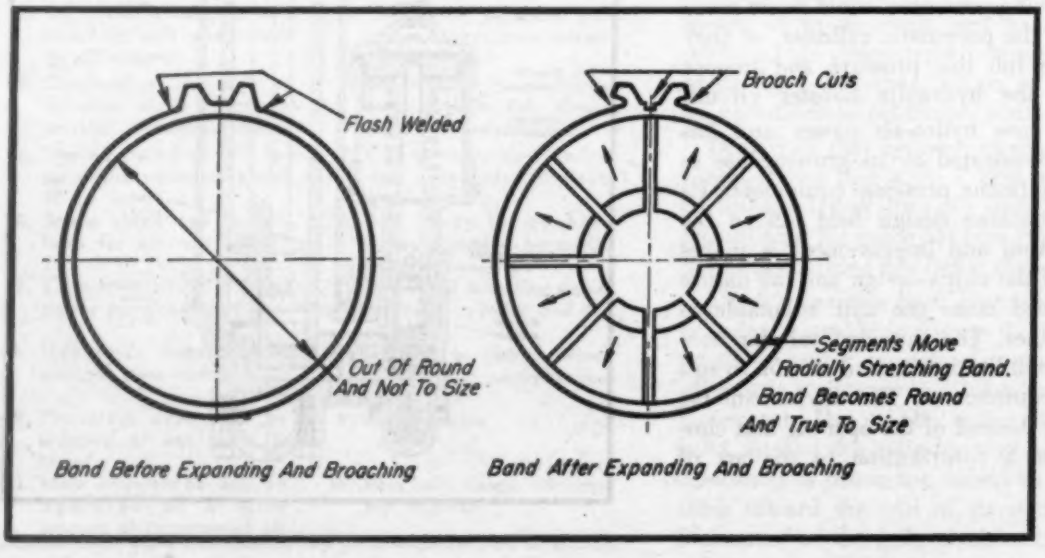



FIG. 1. The job—A segmented arbor was designed to hold welded steel bands during broaching.

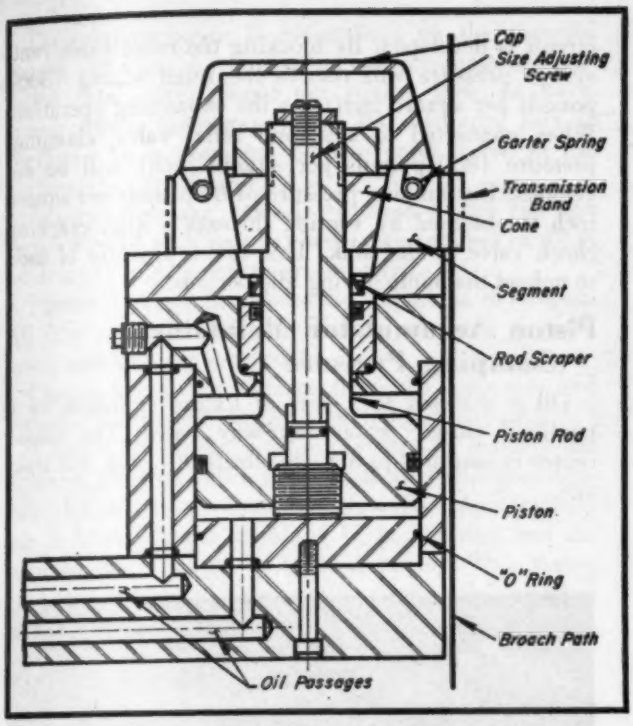



**FIG. 2. View through the broaching fixture.**

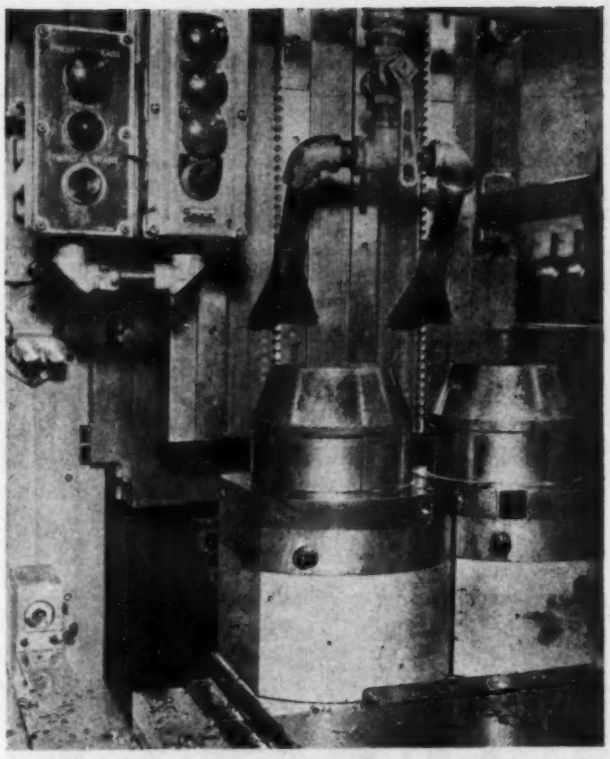


**FIG. 3. Broaching fixture cutters and push button station are shown.**

arranged to work in conjunction with the cutter rams, i.e. one table in for the cut, the other back for loading while its ram returns.

The broaching machine cycle is arranged so that at the completion of a cutting stroke the machine will stop unless its pre-set relay has been activated. This is usually done manually after work pieces have been clamped in the fixture. If the pre-set relay is activated the machine will, at the end of a cutting stroke, automatically reverse its table positions and make a cut with the opposite ram.

## Operating Cycle

Starting the cycle as the broaches finish a cut the following sequence of operations is desirable:

1. Table moves back
2. Fixture unclamps automatically
3. Unload two parts
4. Load two parts
5. Expand part to size with automatic unclamp
6. Clamps parts and activate pre-set relay of broaching machine
7. Broach parts

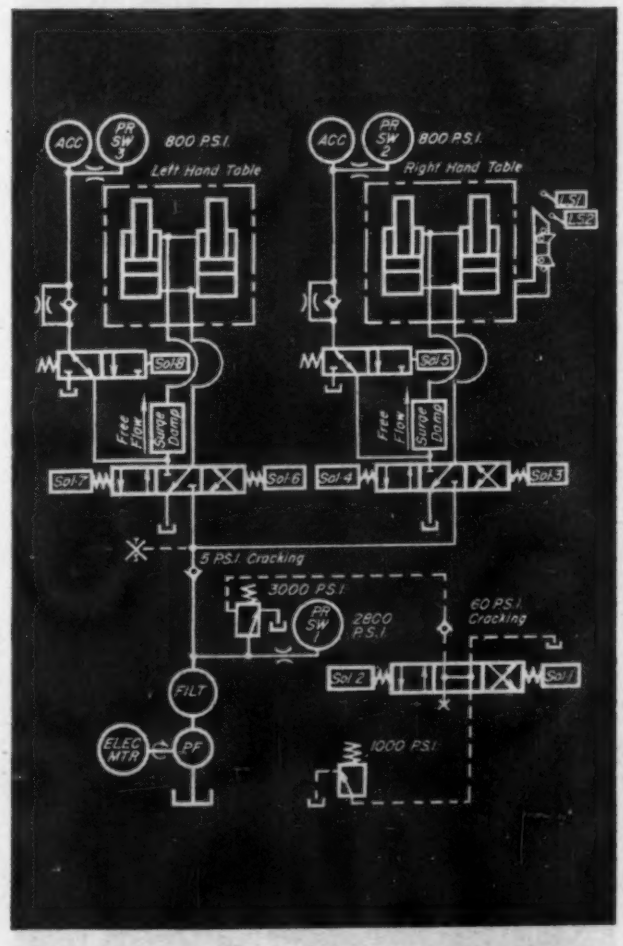
If the pre-set relay has been activated, the first element of the operating cycle will be accomplished.

Movement of the table to the rear can be utilized to unclamp the fixture, completing element two of the cycle.

With the table to the rear and the fixture unclamped, the operator can complete elements three and four.

Elements five and six should be done by operator

**FIG. 4. Hydraulic circuit for the broaching fixture.**



activated push button controls. It is desirable to completely unclamp the parts at the end of the expanding operation so that parts which fail may be removed. Notice that this operation provides a one hundred percent tensile strength inspection of welds in the part.

Figure 3 shows a fixture, the broaching cutters, and the push button control station.

## Hydraulic Circuit— Three Pressure System

Using a hydraulic power unit operating through a vented relief valve as the power source, the hydraulic circuit is developed. By blocking the relief valve vent, system pressure will rise to the relief setting (3000 pounds per square inch) for the expanding operation. When connected to a second relief valve, clamping pressure (800 pounds per square inch) will be developed. Unclamping pressure of 80 pounds per square inch is obtained by venting through a high cracking check valve to the tank. This lower pressure is used to unload the pump during idle periods.

## Piston Accumulator Maintains Clamping Pressure

Oil is directed to a pair of fixture cylinders by a modified closed center four-way valve. The closed center is modified to obviate effects of piston seal leakage.

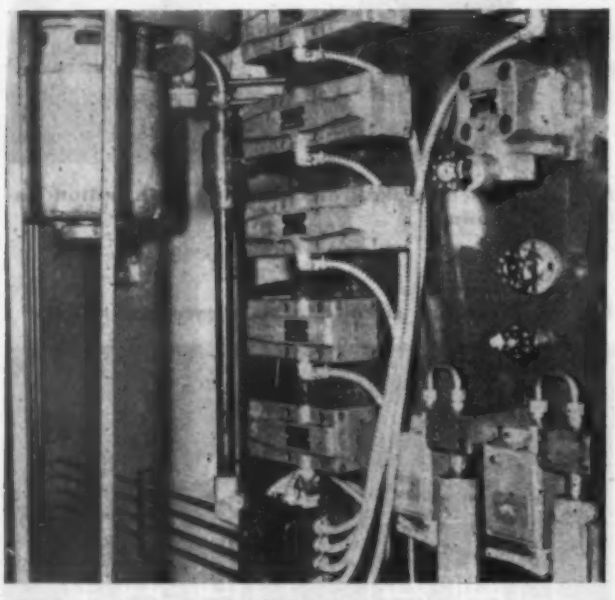


FIG. 5. Valve side of hydraulic panel.

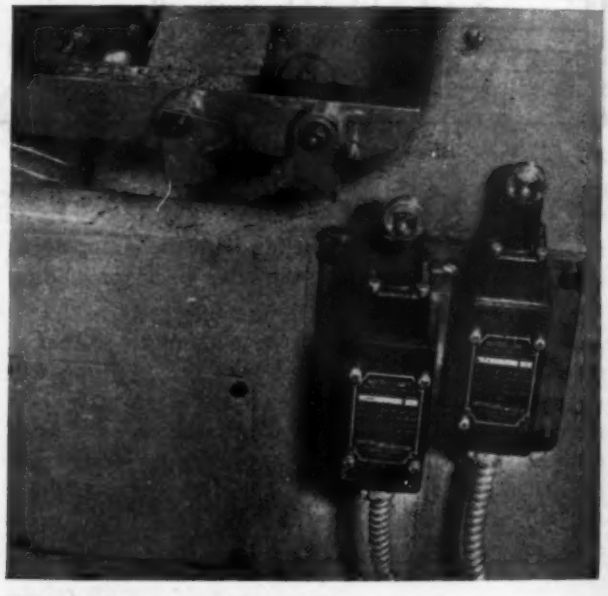


FIG. 7. Cam actuated switches.

FIG. 6. Piping side of hydraulic panel.

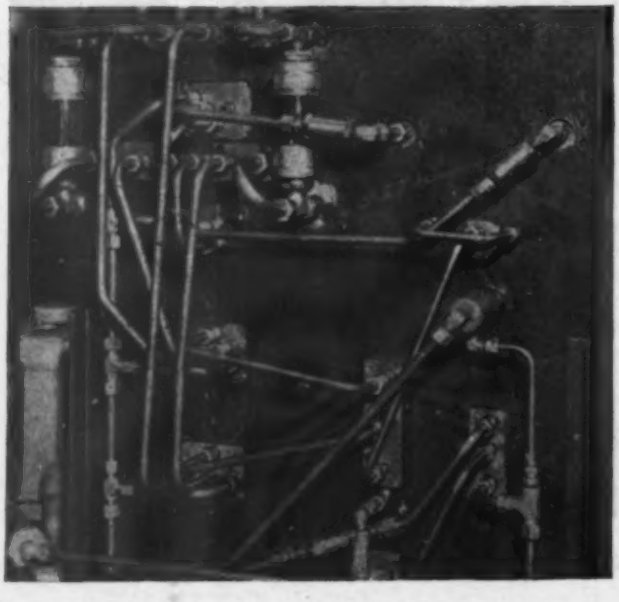
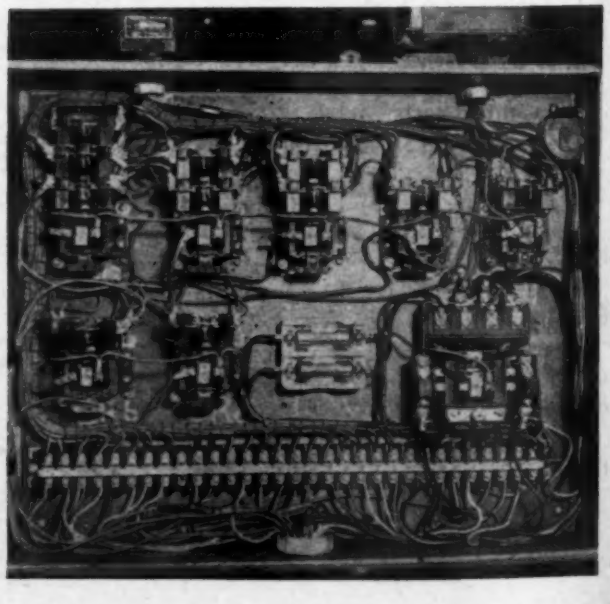


FIG. 8. Electric control panel.



Clamping pressure is maintained on the forward fixture cylinders by a piston type accumulator, protected from 3000 pound per square inch oil by a spring offset, three-way valve. Its discharge rate is regulated by a restricted by-pass check valve in the accumulator supply line.

A surge damping valve is required in the rod end supply line of each fixture since large volumes of oil at moderately high pressure are involved.

Figure 4 shows the hydraulic circuit as developed. All flow control valves are directly operated by solenoids and have ¼ inch ports.

Figures 5 and 6 show respectively the valve side and piping side of the control panel for this circuit.

A length of capillary tubing is used to connect the pressure switches, effectively protecting the Bourdon-tube elements from pressure surges. The capillary tubing is brazed into a standard ¼ inch fitting and assembled into a length of ¼ inch tubing. This makes an easy assembly and the capillary tubing is protected from mechanical damage.

## Electric Control Circuit

Reference to the hydraulic circuit, Figure 4, shows that two solenoids (Sol 1 and Sol 2) are common to both fixtures. The balance of the solenoids are in duplicate systems, one for each fixture.

By alternately connecting the trio of solenoids concerned with one fixture it is possible to use a single set of controls for both fixtures. This is done by a single pole, double throw switch (LSI, Figure 4) actuated by a cam projecting from the right-hand table.

At the mid-point of the table stroke LS1 is actuated to activate controls for one fixture and to de-activate controls for the other. Further movement of the cam in either direction brings a trip and pass dog to a second switch (LS2, Figure 4) which automatically unclamps the retracting fixture. The cam, trip and pass dogs, and limit switches are shown in Figure 7.

Push button stations are used to set up expanding pressure, clamping pressure, and emergency unclamp. Pressure switches are used to indicate required system pressures. In addition a selector switch is provided to allow the broaching machine pre-set relay to be brought in via push buttons provided clamping pressure exists on the fixture.

Figure 9 shows the electric control circuit while Figure 8 is a photograph of the control panel as installed.

In the electric control circuit, Figure 9, notice that expanding pressure relay CR1 will drop out clamping pressure relay CR2, preventing accidental simultaneous energization of solenoids Sol 1 and Sol 2, Figure 4. Similar interlocks are used to protect solenoids Sol 3 and Sol 4 as well as solenoids Sol 6 and Sol 7.

Control relay CR3 is used to bring in machine pre-set relay CRP with the selector switch in the run position. Momentary contact being obtained through the overlapping contacts of control relay CR7. With the selector switch set in the jog position, control relay CR3 allows the machine to be pre-set manually provided clamping pressure exists in the table which will be presented to the broaches.

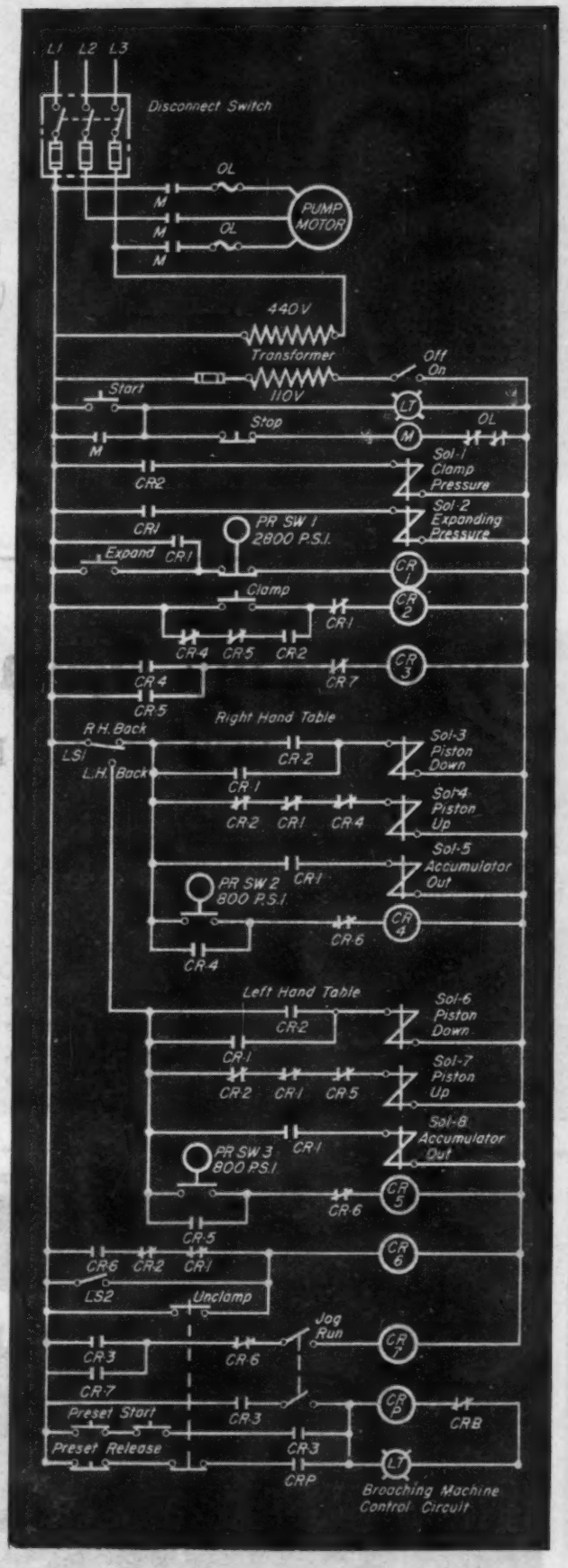



**FIG. 9. Broaching machine control circuit.**

1953

APPLIED HYDRAULICS PRIZE PAPER

Honorable Mention

By W. E. Darby

# Hydraulically Operated Indexing Machine

## FOR LARGE HEAVY PLATES

RECENT developments have called for the design and construction of new indexing equipment capable of accurately indexing larger and heavier plates.

Some form of power is needed to move the considerable mass consisting of the assembly of index slide, arms and clamps which carry the plate through the press, hydraulic power was deemed eminently suitable to give smooth powerful precise movement of the slide, operate the latch for registering in the "V" notches cut in the slide and to close the specially designed clamps which grip the plate.

Figure 1 shows a close up view of a tooling set-up to produce the small punched plate shown in the right hand background. In the center is the hydraulically operated latch. Movement of the slide is arrested at the proper point by rollers on the slide striking a trigger mounted on top of the latch body which opens a micro switch and causes a solenoid operated valve to close

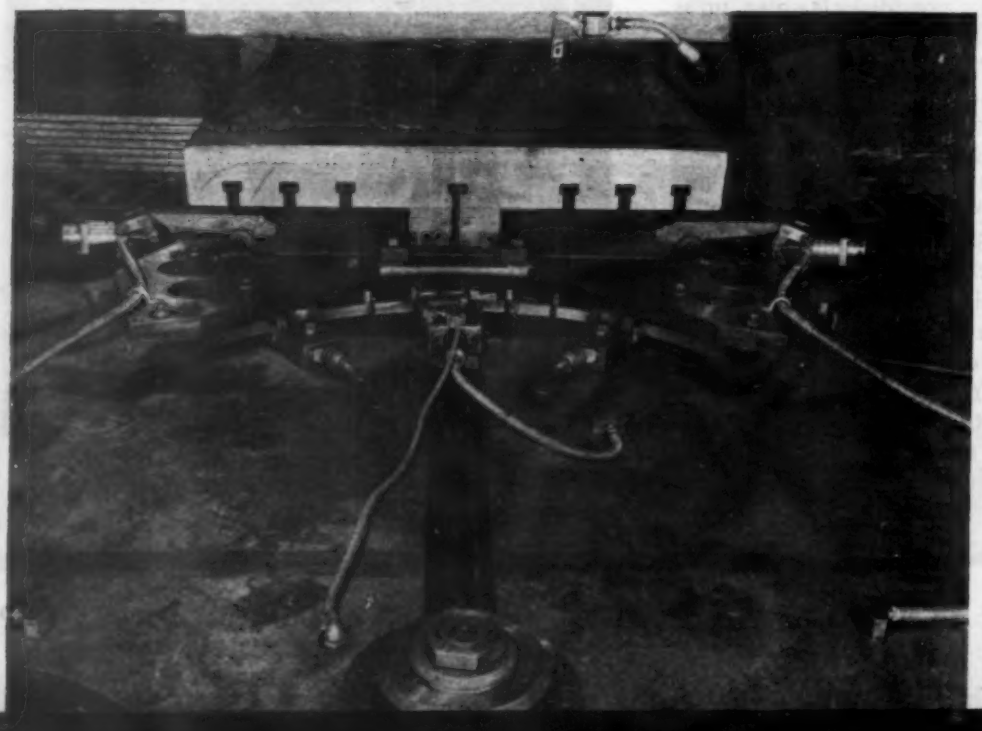
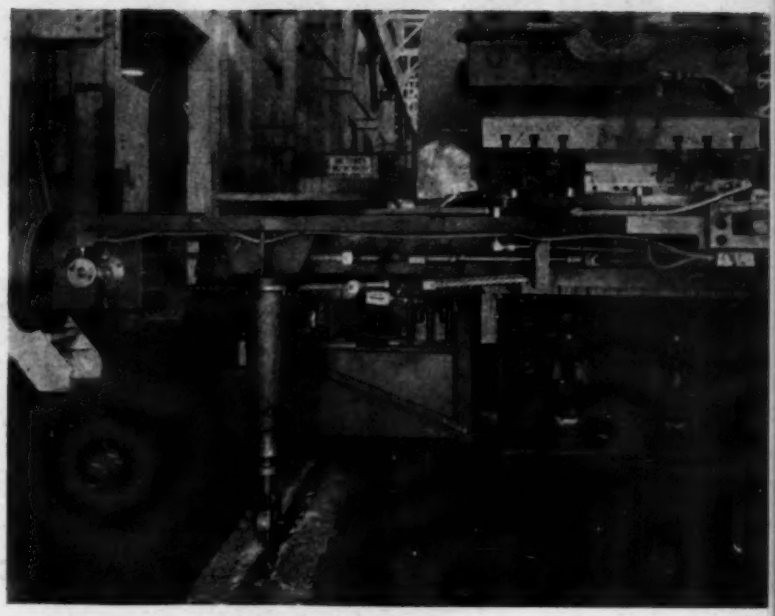


**FIG. 1. Close up view of the tooling set-up to produce the punched plate seen in the right hand background. Hydraulically operated latch is in the center.**

FIG. 2. View of the left hand underside of the index table. A double ended, 20 inch stroke cylinder moves an endless roller chain which rotates cable drums to impart movement to the table.



thereby cutting off the oil supply to the main motor cylinders. There is also a resetting device for closing the micro switch which functions when the latch moves forward. The clamps holding the plate have single acting cylinders with spring return, the toggles do not lock, they merely change the direction of the force. The design of the clamps was conditioned by head room being severely restricted, their gripping power can be varied by allowing the beam to deflect a predetermined amount.

A view of the left hand underside of the table is shown in Figure 2. Underneath the middle of the table is a double ended hydraulic cylinder 3 inches diameter by 20 inch stroke which moves an endless quadruple roller chain over sprockets rotating cable drums through bevel gears. The cables are attached to the slide or dial giving the required motion, limit stops are provided on the bevel boxes and take the form of adjustable cams operating micro switches. When the main control valve is closed the oil is locked in the cylinder acting as an effective brake. Pressure in the latch line opens a pilot operated valve which short circuits the two ends of the main cylinder permitting a correct register of the latch in a "V" notch. Without this short circuit device, the register would be upset by any tension remaining in the cables. The table rests on an angle plate which is bolted to the front of the press, the wheeled legs provide a means of moving the machine away from the press to facilitate handling of the dies.

Figure 3 shows a side view of the machine set-up to produce large punched plates, in this instance a dial is used. All the valves are grouped in the unit which can be seen suspended under the table. The valves in most cases have subplates and are mounted on a central wall with pipes on one side and valves on the other. All the electrical relays are in a panel separate from the machine and insulated from shock. Two operators nor-

FIG. 3. All valves are grouped in a unit seen suspended under the table. Electrical relays are in a panel separate from the machine and insulated from shock.

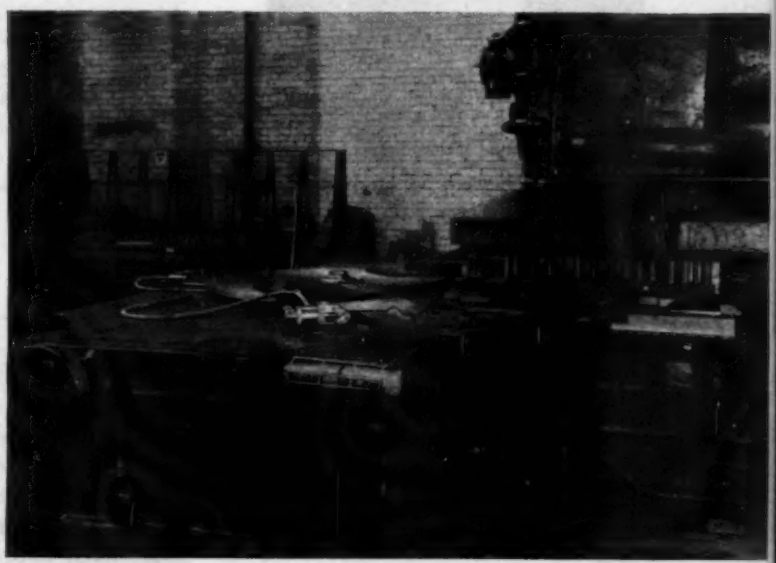
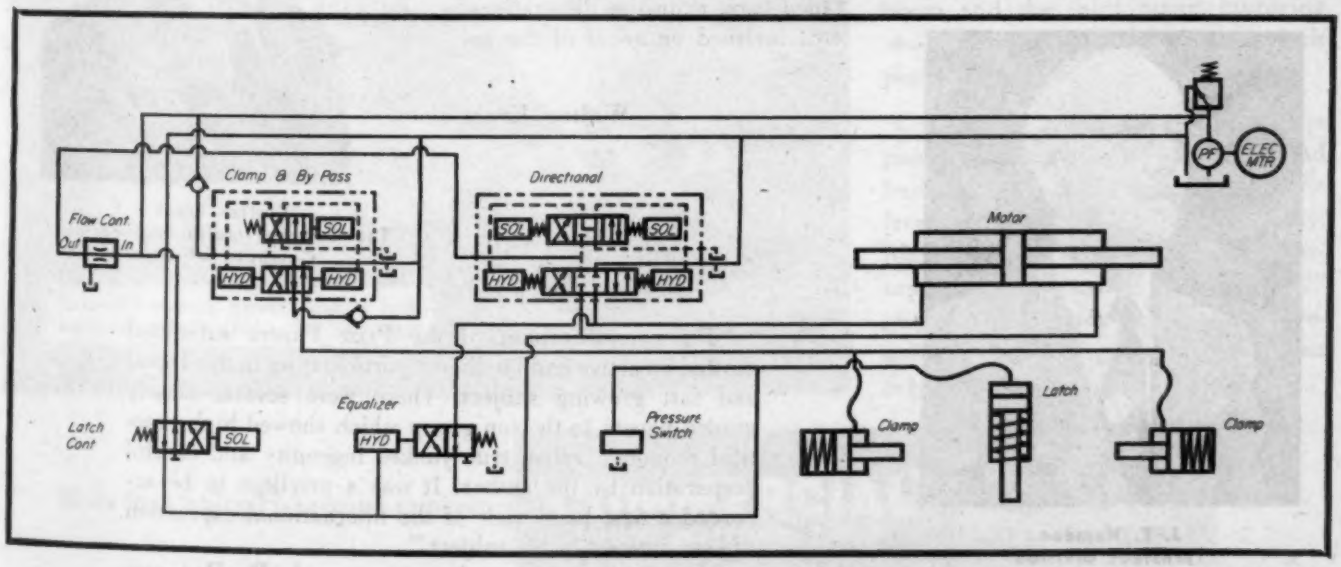


FIG. 4. Hydraulic circuit for the indexing fixture.



mally run the press. One operator controls the two buttons which open and close the clamps. When the clamps are open the oil from the pump goes back to the tank and pressure drops to 60 psi.

The 60 psi pressure is necessary to operate the pilot pistons in the valves but insufficient to move any power pistons should a control button be inadvertently pressed. System pressure is 750 psi. A pressure switch is incorporated in the latch line to ensure that the press cannot be tripped between stations.

The control buttons are in two groups at opposite ends of the machine, the operator on the loading side has control of the clamps and can in an emergency stop all movement by opening the clamps and lowering the system pressure. Conversely the dial can not be moved until the clamps are closed; this is a safety measure. On the unloading side, six control buttons give rapid traverse in either direction, automatic index, (one station at a time) latch in, latch out and press trip. It will be realized that all the necessary elements for an automatic cycle are present and such an arrangement was considered but deemed unwise to use with a press at the present stage of experience.

The machine registers with consistent accuracy and its use has resulted in a marked improvement in the quality of the product.

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# Judges Comment on Contest Entries

Dean M. Cleaveland
Bendix Products Division
Bendix Aviation Corporation

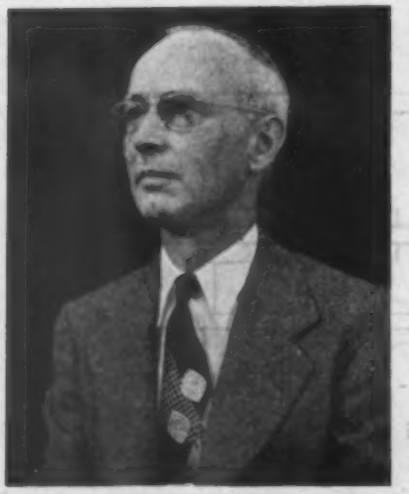
"The papers submitted in this Contest covered a very wide range in the application of hydraulics and pneumatics to industry, which, in my opinion, is an indication of the importance these two methods of power transmission are assuming in everyday industrial applications. Of the papers evaluated, 76.8 percent fell in the above average classification, exceptionally good for a contest of this nature."

**Dean M. Cleaveland**

Walter Ernst
The Commonwealth Engineering Company of Ohio

"I was greatly impressed with the quality of most of the papers, particularly those dealing with the practical aspects of application of hydraulic power which contained many original and useful ideas. I was much impressed with the detailed care, exquisite illustrations, etc., lavished on some of the entries."

**Walter Ernst**



J. R. Hemeon
Ternstedt Division
General Motors Corporation

"The overall caliber of the Prize Papers submitted showed an active and intelligent participation in this broad and fast growing subject. There were several closely graded papers in the top group which showed high practical economic value, true yankee ingenuity and careful preparation by the author. It was a privilege to be accorded a first hand view of the international expression of keen interest in the subject."

**J. R. Hemeon**

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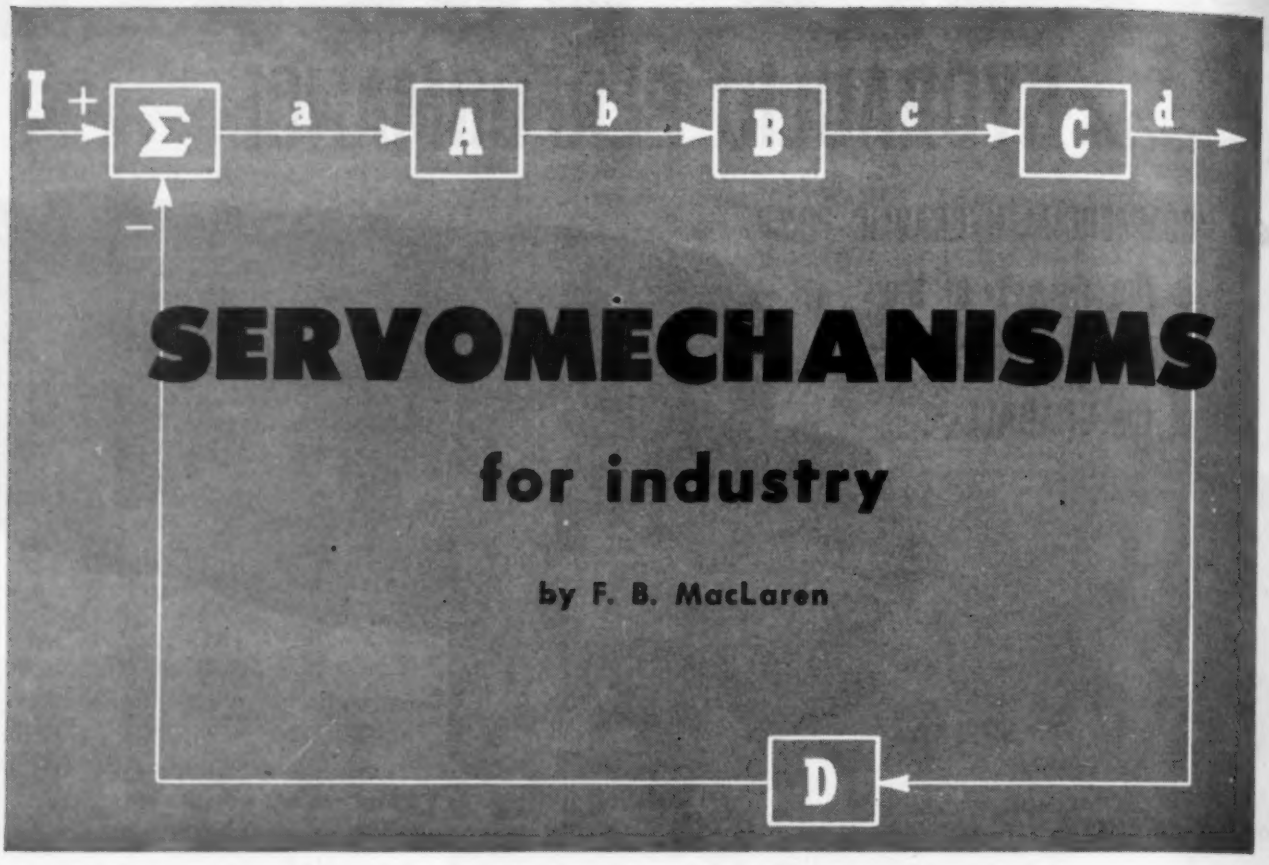


# SERVOMECHANISMS for industry

by F. B. MacLaren

## Part II Design Factors

IN designing complete servomechanism systems for specific applications, a definite procedure should be followed, based on certain criteria established from the system specifications. Practical considerations such as availability and cost of components, reasonable tolerances on mechanical and electronic components and expected friction levels over extended life and temperature extremes, are predominant factors in determining such criteria. A typical set of servo specifications is listed below, illustrating the pertinent factors which should be defined:

| | |
|---|---|
| line power available | 230V 60 cycles 3 phase |
| maximum velocity | 75°/sec. |
| maximum acceleration | 500°/sec. |
| velocity at max. acceleration | 40°/sec. |
| maximum torque | 2500 ft. lbs. |
| maximum horsepower point | 2000 ft. lbs. at 60°/sec. |
| load inertia | 300 slug ft.$^2$ |
| static error | 0.2° max. of output shaft |
| lag due to max. velocity | 0.2° max. of output shaft |
| lag due to max. acceleration | 0.5° max. of output shaft |
| frequency response | 0-15 cycles |
| phase shift | 20° max. of output shaft |
| input | continuous mechanical rotation |
| output | continuous mechanical rotation |
| input/output scale factor | 27:1 |

*F. B. MacLaren, Engineering Consultant, Servomechanisms Inc., Westbury, N. Y.*

The requirements for speed, torque and frequency response of the output are primary considerations in deciding on the type of motor to be employed. Table A may be used as a rough guide in selecting a motor, although the wide overlap of various types often permits a final choice based on availability, cost or maintenance factors. Also, considerable improvement can usually be made in the frequency response range (fidelity) of commercial systems by modified design of the controller or stabilization means, if the additional cost is warranted.

**Table A Motors**

| Type | HP Range | Frequency Range | Features |
|---|---|---|---|
| a-c induction motors | .0001 - .05 | 0-30 cps. | inexpensive, compact, reliable |
| d-c shunt motor | .005 up | 0-5 cps. | efficient, easily controlled |
| magnetic clutch | .01 - .5 | 0-50 cps. | high performance, low control power |
| pneumatic | .05 - 3 | 0-5 cps. | non-hazardous simple controls |
| hydraulic | .5 up | 0-15 cps. | high output, reliable, versatile |

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Circle 188 on Reader Service Card

The absence of brush maintenance, lower speeds, and better control characteristics of a-c induction motors make them the first choice for low power position servos, where reliability and fidelity are paramount. When space is at a premium, d-c motors may

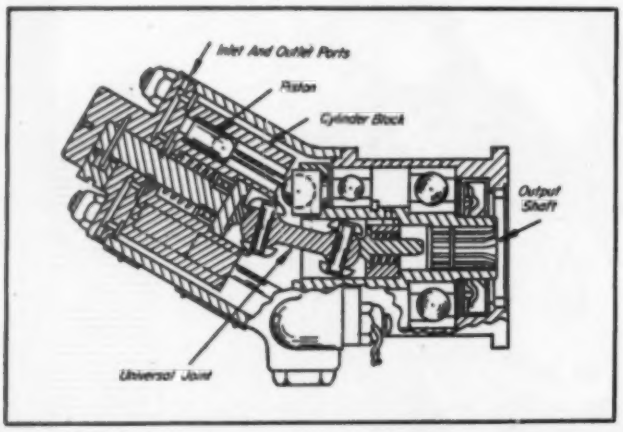


**FIG. 1. Axial Piston hydraulic fluid motor used in servo systems.**

predominate because of their smaller size per unit of power output. The typical torque-speed curve of shunt-wound d-c motors makes them best suited for velocity servos, particularly when the load is not constant. In both a-c and d-c types, power is supplied to the fixed field directly from the line, so that no more than one-half the total power must be controlled.

Clutch servos are very well suited for high fidelity performance in the range indicated, due to their high acceleration capabilities and low control power requirements. However, when delivering maximum torque at zero speed, they receive the greatest wear and must be able to dissipate their rated horsepower in heat.

## Hydraulic Servos for High Power

Hydraulic servos are best adapted to the higher horsepower field, particularly where straight mechanical feedback is possible. Either a translatory or rotary output is available from both hydraulic and pneumatic units, with high control-output power efficiency and good reliability as their outstanding features. Figure 1 shows one type of rotary hydraulic motor in common use.

Pneumatic devices are generally employed as actuators or in control systems involving temperature, pressure or flow in the feedback loop. However, many hazardous installations require the safety features of air control for all servo applications.

The ratio and strength of gearing between the motor and load is readily determined from the slewing speed and stall torque specifications, whereas the backlash is limited by a combination of the dead zone and stabilization requirements. Actually, the motor drives until the feedback unit position satisfies the position called for by the command, within the limits of system accuracy. Backlash in this train will tend to cause hunting if the motor inertia and controller gain are sufficiently high. Any backlash between the feedback unit and load will add to the overall dead zone, although it can also lead to instability because of load

**Table B Transducers**

| Type | Input | Output | Features | Limitations |
|---|---|---|---|---|
| potentiometers | limited mechanical rotation or translation | a-c or d-c voltage | size, cost, low phase shift and quadrature | resolution, noise, wear |
| synchro or resolver | unlimited mechanical rotation | a-c voltage | infinite resolution, good wear | size, cost, phase shift, quadrature, harmonics |
| balanced inductive unit | limited mechanical rotation or translation | a-c voltage | infinite resolution and wear | phase shift quadrature harmonics |
| variable capacitance unit | mechanical rotation or translation | H.F. a-c voltage | low force infinite resolution | drifts, low output, high null voltage |
| variable coupling unit | mechanical rotation or translation | a-c voltage | low force infinite resolution | noise, null spread |
| phototube | light beam | d-c voltage | zero force | sensitivity variation, life |
| air jet | mechanical motion or translation | air pressure variation | low force, good wear | low sensitivity |
| pilot valve | mechanical rotation or translation | fluid flow variation | high sensitivity | friction, cost |
| solenoid valve | a-c or d-c voltage | fluid flow variation | remote control | response time, dead zone |
| diaphragm valve | fluid pressure | mechanical translation | high force output, reliable | output motion |
| pressure transducer | fluid pressure | a-c or d-c voltage | remote control | dead zone, hysteresis, accuracy |
| thermocouple | temperature difference | d-c voltage | wide range | low output |
| Resistance thermometer | temperature change | electrical resistance change | narrow range | high output |
| Pitot tube | fluid flow | pressure change | sensitivity, wide range | accuracy |
| Bourdon Tube | fluid pressure | mechanical motion | low cost, reliable | limited output, hysteresis |
| Bellows | air pressure | mechanical translation | sensitivity, simplicity | hysteresis, vibration sensitive |

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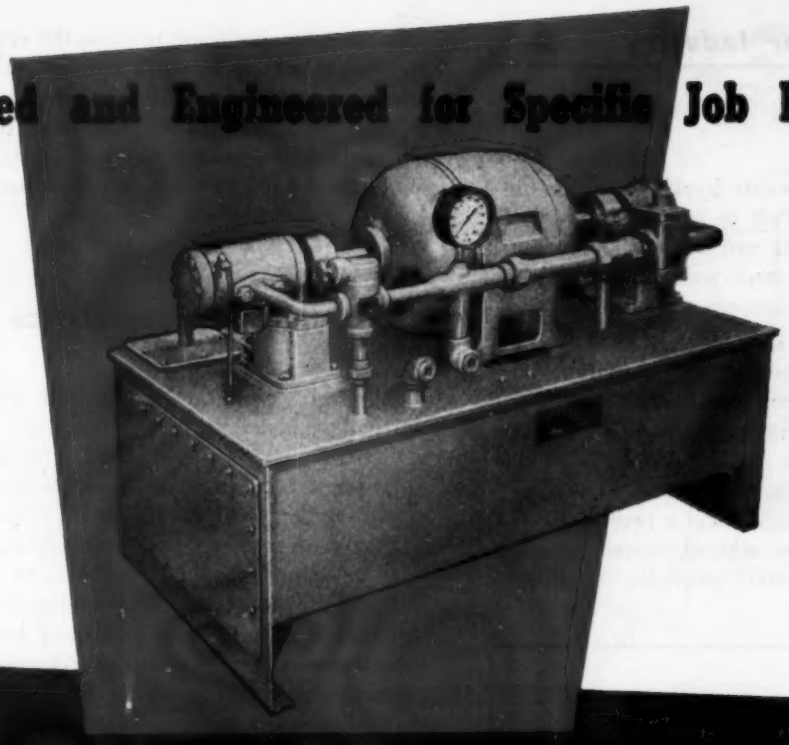

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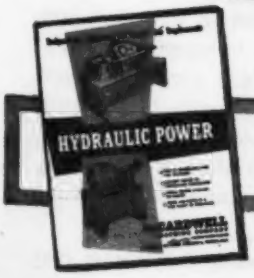


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inertia. The maximum allowable backlash in the output train is therefore difficult to compute, but generally the motor should not run when the feedback shaft is displaced from its null position with either the motor or load shafts clamped.

The choice of a feedback unit is narrowed considerably once the motor has been selected, although sensitivity and accuracy requirements often dictate the use of a particular type. Figure 2 shows an elementary servomechanism of the torque amplifier or follow-up type, having feedback in the form of two contacts on the output drive that control a reversible electric motor when they engage a third contact attached to the input shaft. This merely provides on-off con-

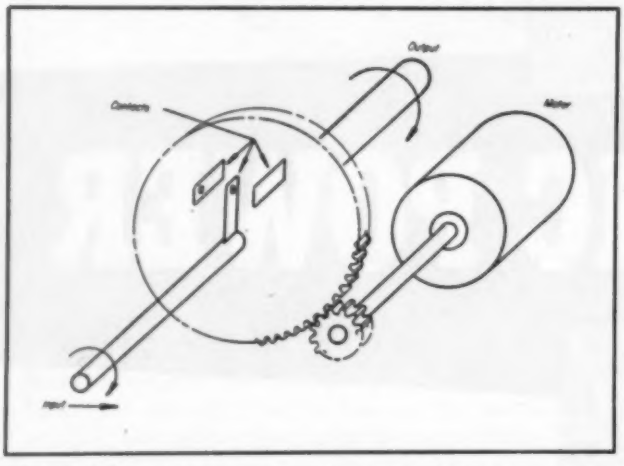



**FIG. 2. Elementary servomechanism of the torque amplifier or follow-up type.**

trol, which results in severe hunting unless there is a wide dead zone between the contacts. By reversing the contact action so they are both closed at the null point, dynamic braking of the motor is obtained, which reduces coasting and permits a smaller dead zone. Although on-off control may be satisfactory for certain applications, the performance obtained is quite inferior to a modulating type of feed-back with its associated controller, which supplies motor speed or torque proportional to the demand. Table B lists several types and salient characteristics of commonly used transducers which are available for modulating control of hydraulic, pneumatic and electric systems. Many other types can be found, but generally fall into one of these categories, with similar limitations and features. Compilation of specifications covering the characteristics listed, together with the type of input and output desired, should make a definite selection readily possible.

When the application demands that the input and output be located remotely, a second transducer is generally employed, as shown schematically in Figure 3. In this case, the command and feedback signals must be combined to form the error signal at the controller, which is more conveniently done if they are in electrical form. It is therefore quite common to find combinations of electrical transducers with hydraulic and pneumatic remote control position servos, but not with actuators or other open loop systems.

## Controller Characteristics

After choosing the motor and transducers for a particular system, the fundamental controller characteristics may be determined. For an electrical system, the motor input voltage necessary to rotate it slowly under load is divided by the error voltage corresponding to the maximum allowable static difference between input and feedback, to obtain the minimum controller gain. If the dynamic requirements are stringent, additional gain may be needed to meet velocity and acceleration specifications without exceeding the dynamic error limits. In addition, the controller must have sufficient power output to develop the necessary stall torque and acceleration from the motor. There are many further detail requirements for phase shift, noise attenuation, stability, etc., which are associated with any electronic amplifier design.

These gain and power output characteristics apply equally well to hydraulic or pneumatic controllers, if the corresponding terms are used. For example, mo-

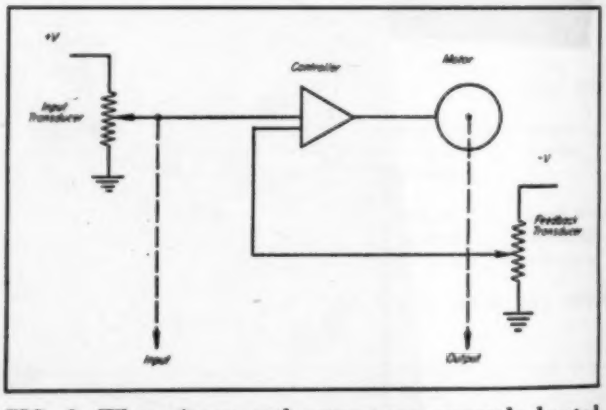
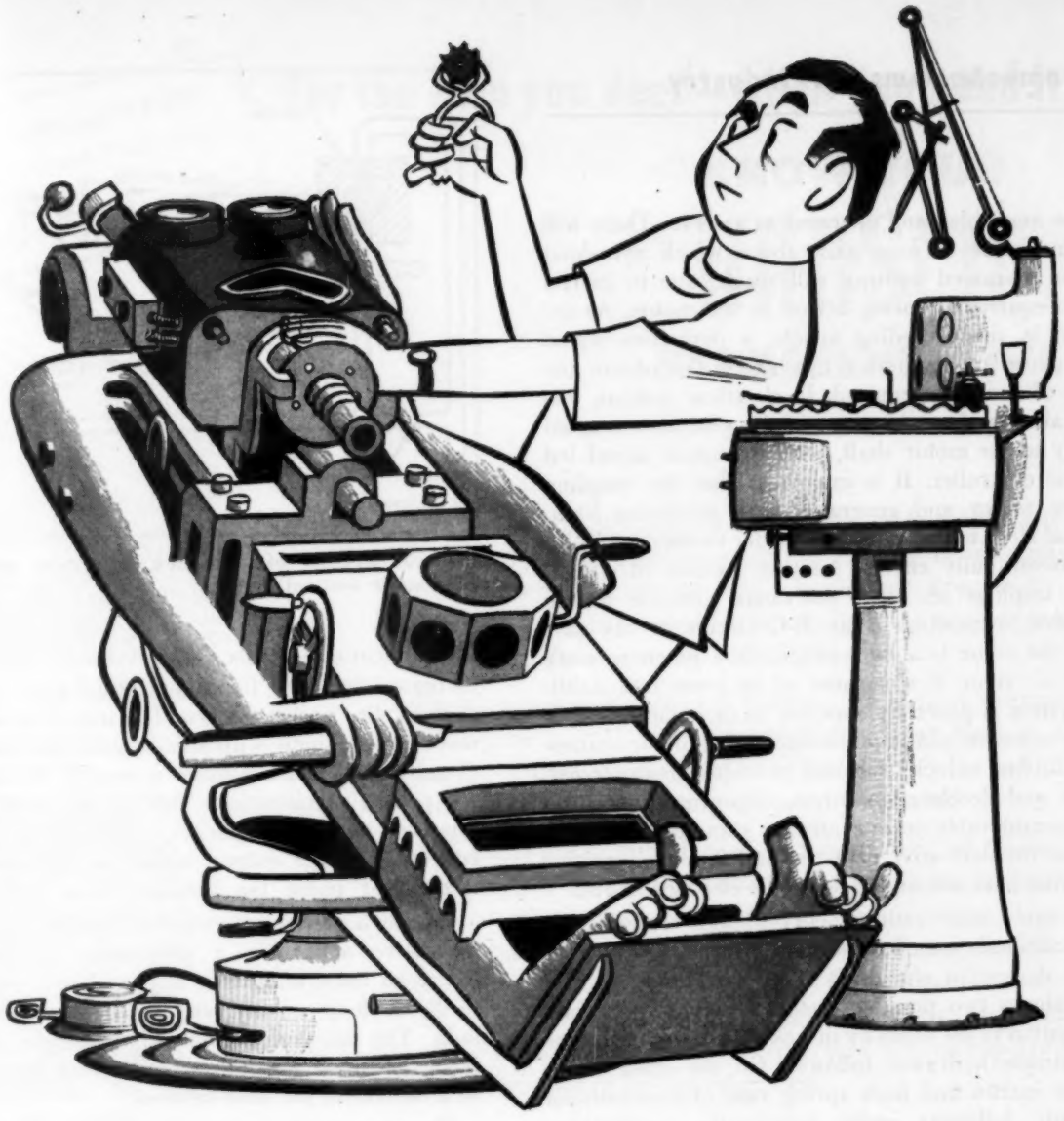



**FIG. 3. Where input and output are remotely located a second transducer is generally used.**

tion of a pilot control valve must cause sufficient change in pressure or flow (depending on the type of system), to meet the gain requirements defined above. Similarly, the power output in terms of pressure times flow must be adequate to supply the motor force demand. The design of fluid controllers generally involves close tolerances on parts to minimize leakage without introducing excessive friction, although dither is often used to maintain a slight, continuous oscillation of the system, and thereby eliminate static friction.

Having selected the basic elements, the system may



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then be assembled and operated as a servo. There will be some value of loop gain above which overshoot or even sustained hunting will result, due to inertia and an equivalent spring action in the motor. As explained in the preceding article, a derivative signal is employed to counteract this effect and obtain the degree of damping required. In electrical systems, this often takes the form of an a-c or d-c generator coupled directly to the motor shaft, with its output signal fed into the controller. It is important that the coupling between motor and generator have minimum backlash and close to unity ratio, in order to decrease noise and discontinuity effects. Another method of stabilization employs an error derivative network in the controller, consisting of an R-C circuit in the case where the error is a d-c voltage, or a notch network for an a-c error. Performance of an error rate stabilized system is generally superior to tachometer stabilization since it adds no inertia to the motor, causes no additional velocity lag and provides greater acceleration and deceleration forces. However, it does require considerably more controller gain due to attentuation in the derivative network, and is more sensitive to gearing backlash and noise in the electrical inputs.

The same stabilization theory applies to fluid systems, although manipulation of pressure or flow to obtain derivative signals is more cumbersome. Figure 4 shows two possible methods of obtaining rate information to the input by means of dashpot couplings on a simple hydraulic follower. On the other hand, the low inertia and high spring rate of conventional hydraulic followers make stabilization unnecessary except where very high performance is required. In the case of rotary hydraulic systems however, the

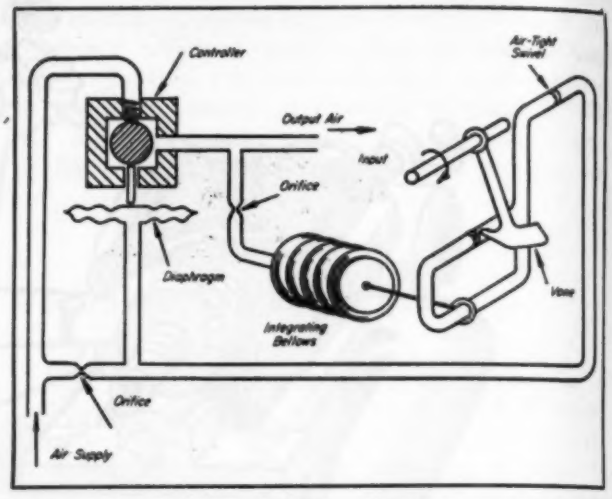


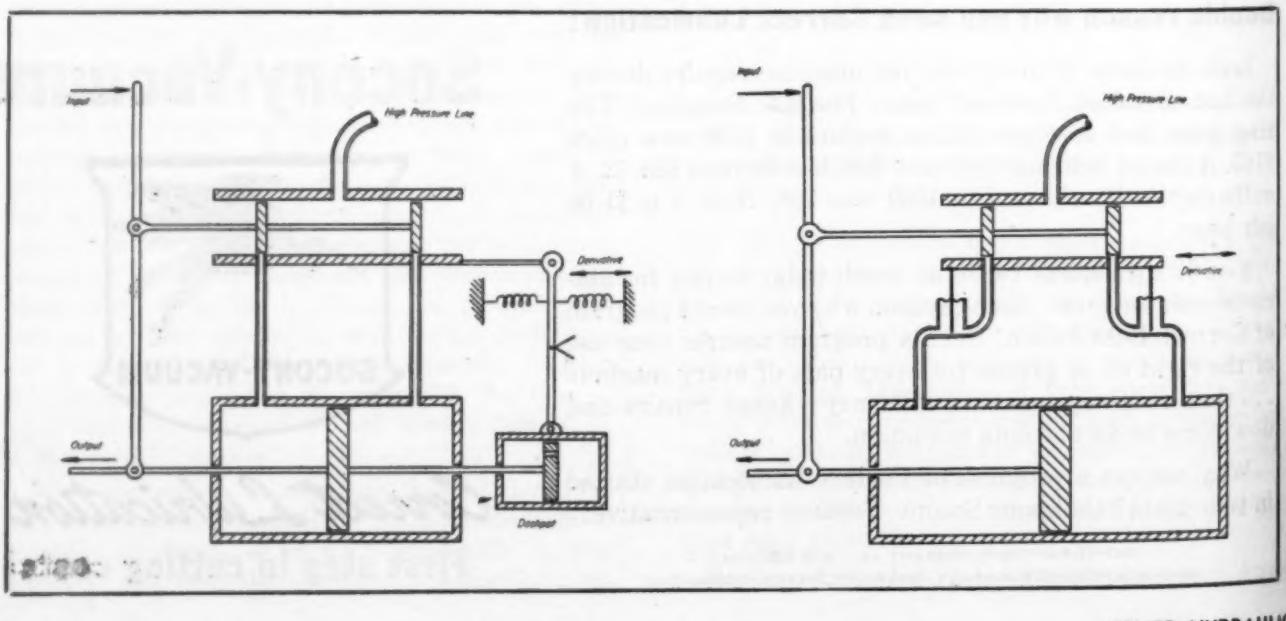

**FIG. 5. Method of obtaining derivative action in a pneumatic control system.**

input position controls output velocity, which greatly increases the need for stabilization when used as a high fidelity position servo. The use of an electric remote control loop with this system introduces additional delays which require a second derivative term for perfect stabilization. This is also true of clutch type servos, since a position error signal causes acceleration of the output, which is equivalent to 180 degrees of phase lag between input and feedback.

Figure 5 shows an alternate method of obtaining derivative action in a pneumatic control system, where an integrating unit is placed in a degenerative feedback loop around the input—controller output loop. The integral of output is thereby subtracted from the input, which is a satisfactory approximation of a derivative for most systems.

The next article in this series will present examples of the various systems mentioned, in typical industrial applications.

**FIG. 4. Two methods are shown for obtaining rate information to the input by means of dashput couplings on a simple hydraulic follower.**



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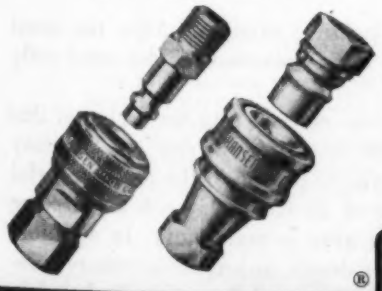

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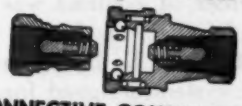

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# Development of the Corsair HYDRAULIC SYSTEM

By Dwight E. Leach

THE basic Corsair, or F4U as it is officially known, was conceived early in 1938 in response to a Navy design competition to build a high performance shipboard fighter. A contract was received, and in May, 1940 the XF4U-1, the first of 12,571 airplanes which were destined to be built, was test flown. The basic hydraulic system designed for this airplane remained unchanged in its main features throughout the production life of the plane. The modifications that were made paralleled the development of aircraft hydraulic components for over ten years.

Production of the Chance Vought Corsair, one of the Navy's greatest propellor driven fighter airplanes, came to an end in December, 1952, when the last F4U-7 rolled off the end of the production line in Dallas, a few days before Christmas. After the usual "shake down", these last airplanes were delivered early in 1953.

A great many factors entered into the design of this airplane. It was built around the Pratt and Whitney R-2800 engine and was to be one of the most powerful and fastest airplanes of its time. On such an airplane a retractable landing gear is mandatory. In addition, controllable oil cooler doors, an engine accessory compartment door and engine cowl flaps were included in the design. To assist in take-off and to provide lower landing speed, wing flaps were needed. For landing aboard a carrier an arresting hook was needed, a hook that was retractable in flight. For parking in a minimum of space, either on shipboard or ashore, folding

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***1500 psi hydraulic system on the Corsair F4U5. Drawing shows all utilities powered by oil. Circuit development started in 1938 with a 5 gpm 1100 psi system.*** →

wings were provided. To accomplish these various functions some sort of built-in power system was required. A hydraulic system was selected as the simplest and most reliable means of providing these functions.

### *Basic Power System*

The XF4U-1, and the production model F4U-1 which followed it, used a fixed displacement hydraulic pump which delivered approximately 5 gpm at the maximum system pressure of 1100 psi. For ground operation, or for emergency use in flight in the event of failure of the engine driven pump, a hand pump was provided in the pilot's cockpit. In order that the main pump would not continually draw power from the engine and dissipate it as heat through a relief valve when no hydraulic services were being operated, an accumulator and unloader valve were provided. The unloader valve, or pressure regulator, is essentially an automatic valve which, when no hydraulic power is being used and the system reaches a pre-determined high pressure, shifts over to hold that pressure, permitting the pump to circulate fluid from and to the reservoir at a very low pressure. These units made up the so-called basic power system.

### *Landing Gear Circuit*

Each of the various branch or utility sub-systems was designed to meet certain specific requirements, peculiar with that system. The landing gear and tail wheel were actuated by two separate portions of a three bank, four-way, manually operated valve.

Recognizing that the power system might occasionally fail to function, due to engine stoppage, gunfire damage or some sort of mechanical failure, an emergency system was provided. This consisted of a carbon dioxide cylinder with provision to discharge the compressed gas through suitable shuttle valves into the actuating cylinders and thus "blow" the landing gear down. To prevent any possibility of a hydraulic lock holding the gear up, a small actuating cylinder in the $CO_2$ system operated three-way emergency bypass valves to dump return oil directly into the reservoir.

### *Wing Fold Circuit*

The wing fold system, for obvious reasons, was intended only for ground operation and was actuated by the third section of the manual four-way bank valve. A simple two position control lever, provided with suitable safety locks, was installed in the cockpit. Sequence valves were provided to assure that the wing fold cylinders, and the wing hinge pin cylinders, always worked in the proper order.

### *Wing Flap Circuit*

Design requirements for the wing flap circuit were somewhat more complex. It was desired that it be possible to position the flaps at any partially open position, which would be proportional to the degree of movement of the control handle in the cockpit. In addition, provision was to be incorporated so that if the airplane was flown at more than a certain air speed the flaps would automatically "blow closed", and so prevent overloading the airplane structure. When the airplane speed was reduced, the flaps were to re-open automatically to their originally set position. To assure that the flaps would move together, a flow equalizer was used in the "down" line.

The positioning requirement was met by using a

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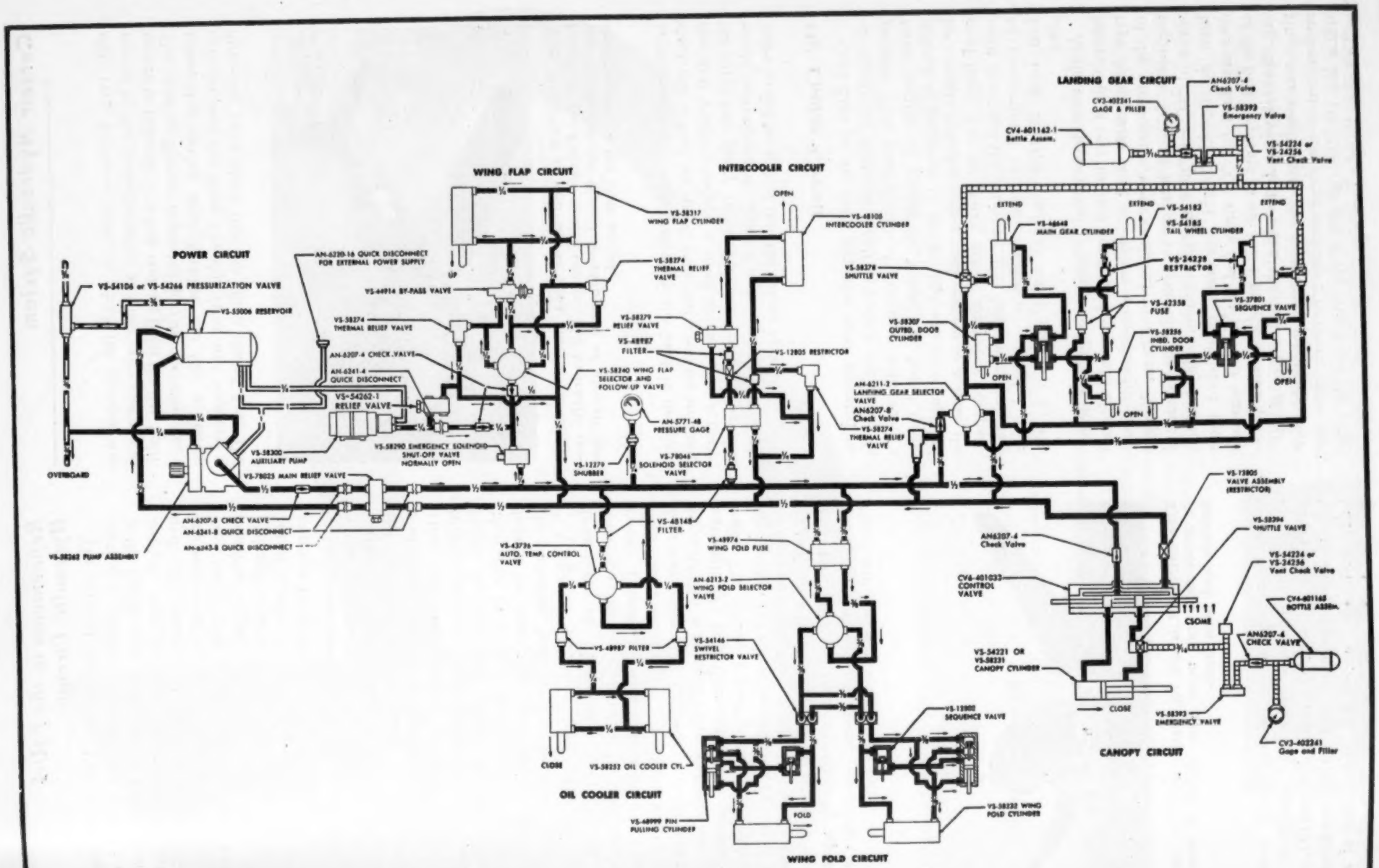
Dwight E. Leach is a Staff Engineer, Controls and Hydraulic Staff Group, at Chance Vought Aircraft. He has had a closely integrated part in the post-war development of the hydraulic services for the Corsair, as well as other Chance Vought aircraft and is in a particularly advantageous position to tell this story. He points out that the accompanying picture of himself has been cleared by the Texas Chamber of Commerce.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VS-53006 RESERVOIR
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WING FOLD CIRCUIT

## Corsair Hydraulic System

slide type, four-way valve in which the plunger was moved by the cockpit control and the valve sleeve was moved to follow it by a link coming from the flap itself. The blow-up feature depended for its operation on a telescoping spring strut between the flap actuating cylinder and the flaps. On this strut was mounted a three-way valve piped into the "flaps down" line. The

**THE MARINES as well as the Navy carried the lethal punch of the Corsair to the enemy. The hydraulic system illustrated the typical development of aircraft hydraulics over a ten year period.**

arrangement was such that when the load in the flap strut, due to high air speed, exceeded a certain amount, the strut would telescope a small amount and actuate the three-way dump valve. Pressure from the system would be temporarily shut off and some oil in the cylinder would be spilled into the return system.

### *Oil Cooler Circuit*

Cowl flaps on the early airplanes were actuated individually by eighteen small cylinders connected in parallel. This multiplicity of cylinders with such a large number of connecting tubes was found to be difficult to maintain in service and was soon replaced by a single cylinder with a cable system to actuate the cowl flaps. The oil cooler doors, accessory compartment door and the arresting gear hook were actuated by conventional hydraulic cylinders controlled by a four bank multiple four-way valve operated by the pilot.

At the time the original hydraulic design was undertaken, only a very limited number of standard aircraft type components were available; consequently many of the components were designed by Chance Vought engineers. It is of interest to note that the standard series of "O" ring packings so common today had not been developed. Vought engineers established their own standard for "O" rings and the Corsair was one of the first airplanes to use this type of hydraulic packing. Several years later when the AN series of "O" rings was established, the airplane components were re-designed to use these packings; however, there are still a few old Corsairs still flying which use the original Chance Vought packings.

### *Refinements in the F4U-4 Hydraulic Circuits*

The original Corsair, the F4U-1, continued in production for about four years and played a major role in the Pacific war. A number of variations of the basic airplane were produced, but no major change in the hydraulic system was found to be necessary. Vought engineers had been busy on an improved design, however, and in 1944 production of the F4U-4 with a more powerful engine and other improvements began. The hydraulic system of the new airplane contained a number of changes to meet new operating conditions and to improve reliability.

The power system in the F4U-4 remained essentially unchanged except for the addition of reservoir pressurization. Pressurization air was obtained direct from the carburetor air scoop and, depending on air speed and altitude, varied from 1 to 9 psi gage. This provided improved operation of the hydraulic system at altitude and gave longer pump life by minimizing cavitation. An important change was the elimination of hydraulic lines from the cockpit area, as there had been a few cases where a failure, or battle damage to the plumbing, had drenched the pilot with oil.

A number of minor refinements in the various branch circuits were made. The four bank, four-way selector valve was eliminated; the cowl flaps and intercooler (which replaced the accessory compartment door) were actuated by a two bank solenoid operated, four-way valve. The oil cooler circuit was no longer regulated by a manual valve, but was now controlled automatically by a thermostatically operated four-way valve. The arresting gear circuit remained essentially unchanged, but was now operated by one of the banks of the remaining three bank, four-way valve. Experience showed that there was no point in the landing gear and tail wheel being operated by separate four-way valves; accordingly, these two circuits were combined and operated by a single valve.

**THE CORSAIR is still on "active duty". At the end of its production trail more than 12,500 of these sturdy fighters had been built.**

One improvement in the emergency system was made. The separate three-way emergency bypass valves were replaced by a newly designed $CO_2$ operated bypass valve. The wing fold circuit remained essentially unchanged, except for the addition of a return flow fuse. This was considered desirable as it was

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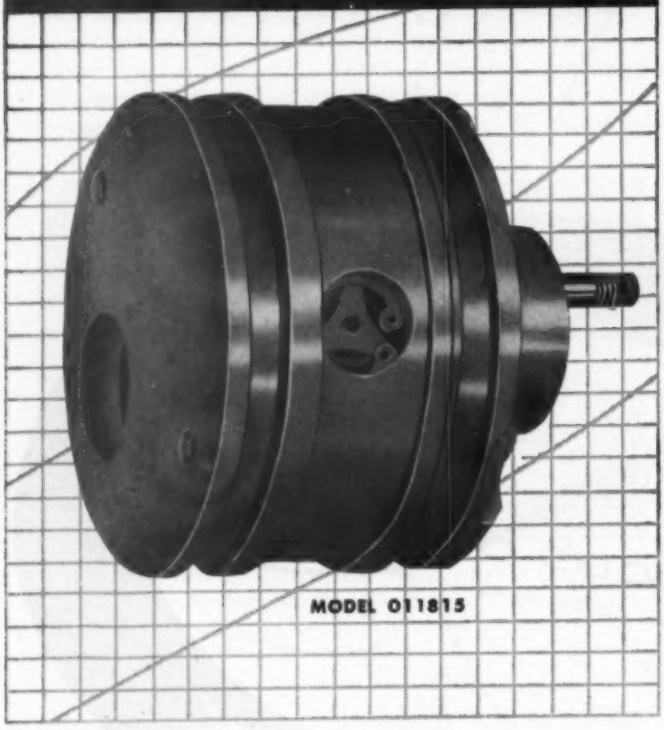


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## Corsair Hydraulic System

Continued

standard practice to keep hydraulic pressure in the "wing spread" lines; any damage to these lines in flight would mean the loss of the entire hydraulic system. The flow equalizer in the wing flaps circuit was found to be unnecessary and was eliminated.

These were the significant changes in the F4U-4 from its predecessor the F4U-1, and, except for minor refinements, this was the airplane which remained in production until the end of the war.

Following the war airplane production at Chance Vought, as at all other plane plants, was drastically reduced, and Chance Vought engineers could turn their attention from production problems to the design of a new and better Corsair—the F4U-5. A more powerful engine and newer and improved types of equipment were installed. The hydraulic system came in for its share of attention.

### *Power Circuit*

The most important hydraulic changes in the F4U-5 airplane were in the main power system. System pressure was increased from 1000 psi to 1500 psi and a new engine driven, pressure controlled, variable volume pump was installed. This replaced the old fixed displacement pump, accumulator and unloading valve system which had seen the Corsair through the war. The hand pump, too, was replaced by a small electrically driven pump for ground or emergency flight operation.

Most of the utility circuits remained essentially unchanged, except for re-design of the components to operate at higher pressure. The engine cowl flap circuit was changed from hydraulic to electric operation and a new circuit for power operation of the pilot's canopy took its place.

### *Canopy Circuit*

For several years, as airplane speed and altitude kept increasing, it had been increasingly difficult to operate the canopy by hand; on the F4U-5 it was decided to use power. This decision, however, immediately raised the question of what to do in an emergency in the event of hydraulic failure. Manual operation of the canopy was retained by providing a latch which would disconnect the actuating cylinder; an emergency power source was also considered necessary.

The emergency system for the landing gear on the F4U-1 and F4U-4 airplanes had been a carbon dioxide cylinder. This had been generally satisfactory, except for one rather serious disadvantage. As is well known, carbon dioxide liquefies rather easily and the maximum pressure available in a cylinder is no more than the vapor pressure of the fluid at existing temperature. This pressure was sufficient for operation of systems somewhat below 1000 psi; the disadvantage was that a pressure gage could not be used to record the amount of gas, and, consequently, the available energy in the cylinder. The only means of checking whether a cylinder was full was to remove it from the airplane and weigh it. Regrettably this check was sometimes over-


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looked and a number of airplanes made wheels up landings when, following a hydraulic failure, the pilot found the $CO_2$ cylinder empty.

These considerations, coupled with the fact that $CO_2$ pressure was no longer sufficient to operate 1500 psi cylinders, led to the use of air bottles. Such bottles could easily be charged to 1800 psi and, as air does not liquefy at this pressure, a pressure gage could be used to show how much air the bottle contained. Service experience to date has shown that the compressed air system is more reliable than the old $CO_2$ system. This system was chosen, for these reasons, for canopy emergency opening.

The landing gear system remained basically unchanged, except for the use of emergency air bottles in place of carbon dioxide. The other utility circuits remained the same, except for redesign of components to operate at 1500 psi instead of 1000 psi. One valve change may be of interest. The flap selector valve, which from the original Corsair had been a follow-up type, lapped slide valve, was changed to a poppet type four-way valve with a suitable gear and linkage follow-up system. This valve was somewhat easier to fabricate and, while it is a little more difficult to rig, has proved satisfactory.

With the rapid development of jet fighters it might be expected that the old Corsair has seen its day, but this is not the case. The Corsair was in action to the end of the fighting in Korea. The last two models of the Corsair, the AU-1 and F4U-7, contained no basic hydraulic changes beyond the F4U-5 and for the most part the systems are performing satisfactorily today.


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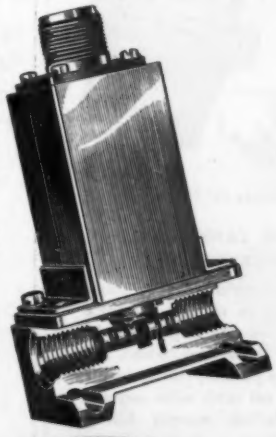

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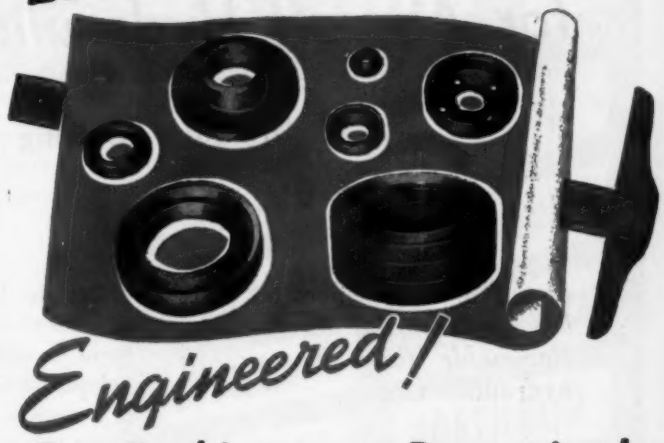

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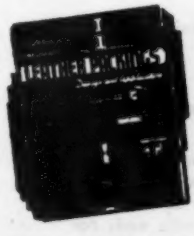

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# Nonflammable Fluids for Aircraft Hydraulic Systems

By John A. King

*Here's a short report on what has been done to develop nonflammable fluid for aircraft hydraulic systems.*

THE present hydraulic fluid used by the United States Air Force, Specification MIL-0-5606, has proven to be very satisfactory. It is inexpensive, stable, a good lubricant and noncorrosive. However, the "red oil," as it is called, is flammable and will support combustion.

In the interest of flying safety, the Materials Laboratory, Directorate of Research, Wright Air Development Center, Air Research and Development Command, has conducted a research and development program to develop a satisfactory nonflammable hydraulic fluid. In this project the philosophy has been to develop a fluid with satisfactory nonflammable properties without sacrificing any of the desirable properties necessary for a hydraulic fluid, such as low temperature operation, oxidation-corrosion resistance, lubricity, and general fluid stability.[1] The requirements of this philosophy were expressed in Specification MIL-F-7100, "Fluid; Hydraulic, Nonflammable, Aircraft." As it was evident that no materials were available which would satisfy these requirements, a research and development program was directed toward the synthesis of two classes of organic compounds which were known to possess nonflammable properties.[2, 3, 4]

*JOHN A. KING, 1st Lt., USAF, Wright Air Development Center, Air Research and Development Command, Dayton, Ohio*

## "Halocarbons" Investigated

An investigation of the first class of compounds, namely the halogen-containing organic materials, or as they are commonly called "halocarbons," showed that the perfluoro-compounds were unsatisfactory due to poor solubility with blending materials, poor viscosity, and narrow liquid range.[3,4] The chlorofluoroalkenes and -alkanes were synthesized and these compounds exhibited good snuffing properties.[3,4] They were also useful as anti-wear additives.[4] The aliphatic bromine compounds were found to be good snuffers but poor stability and narrow liquid range was prevalent in this class.[3] Of all the aromatic halogen compounds considered, only the brominated benzenes were found to be useful as base stocks or snuffers.[2]

The organophosphorous compounds were the second class of organic materials synthesized.[3,4,5] The phosphates and phosphonates were found to be useful as nonflammable hydraulic fluid base materials.[5]

## Development of Three Nonflammable Fluids

Three finished hydraulic fluids were formulated using the above classes of materials either as base stocks or snuffer additives. They are:

a. A silicone, diester, petroleum based fluid utilizing a halocarbon as a snuffer and a mixture of the other components to attain the desired physical properties. The original formulations of this fluid were made by the Materials Laboratory and released to any interested industry. Dow Corning Company have further developed this fluid to a point where the physical properties are a designers dream. For example, the viscosity at —65 F is 350 centistokes. and at 130 F


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—13.9 centistokes. It is also compatible with the presently used elastomeric seals. This fluid is classified as less flammable but it does not support combustion.

b. An organophosphorous base fluid developed by the Monsanto Chemical Company and the Douglas Aircraft Company in cooperation with the USAF. This fluid is not compatible with the presently used elastomeric seals and it is also classified less flammable. However, an elastomer is available which is compatible with the fluid.

c. A brominated benzene base fluid developed by the Pennsylvania State College under an Air Force Contract. This fluid is completely nonflammable but up to the present time no packings have been available. However through industrial cooperation some promising packings have been obtained and are presently being evaluated.

## Laboratory Tests Continue on Nonflams

These fluids are operable from −65 to 250 F and although they do not completely meet all of the requirements of Specification MIL-F-7100 they offer a good compromise. Further testing is being conducted in a hydraulic system mock-up unit, packing cycling testers and pump test stands.

When the fluids have been thoroughly evaluated in the laboratory and found to be satisfactory, flight testing will be conducted with the assurance that nonflammability will be achieved without sacrificing the other important requirements in a hydraulic fluid.

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2. Pennsylvania State College—Reports on Contract AF 33(038)—18193.
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5. Shell Development Company—Organophosphorous Compounds—Contract N9—87500—87501—Office of Naval Research.



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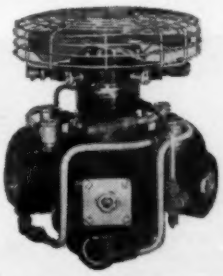

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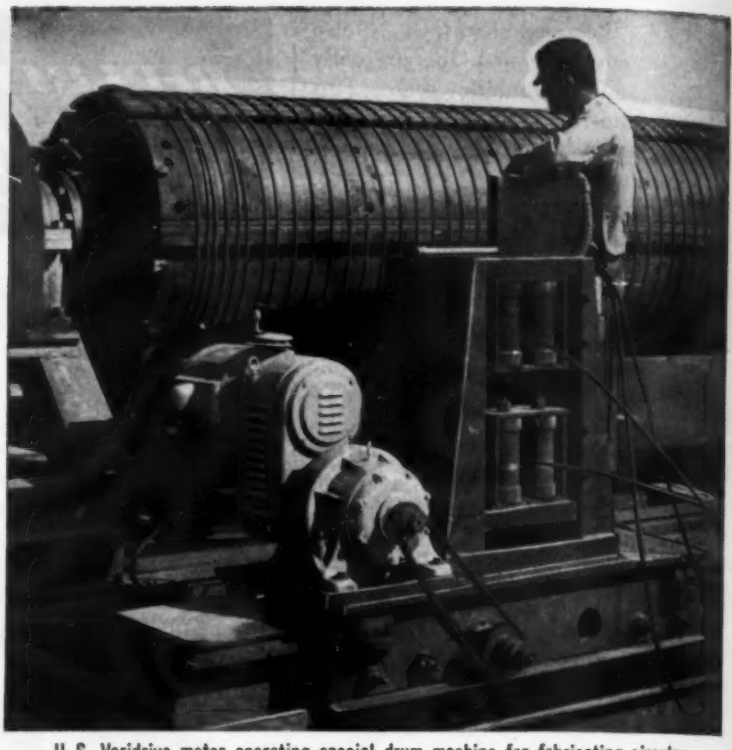
THIS MONTH'S MOTOR TIPS

# How Variable Speeds *improve production tempo*



U. S. Varidrive motor operating special drum machine for fabricating circular reinforcing cages for concrete pipe; permits speed variation to suit each diameter of wrapping.

## COUNTLESS PLANTS ARE SWITCHING TO VARIDRIVE MOTORS FOR OUTPUT EFFICIENCY

MAKING machines more responsive to the operator's command has resulted in an amazing step-up in production. Machines powered with conventional constant-speed motors "loaf on the job" during many operations, but the same machines driven with Varidrive motors can accomplish one or a combination of these improvements—(1) increase production by the adjustable "overdrive" of accelerated speed; (2) effect better cutting or operating action by setting speed at the precise rpm essential for the job; (3) provide the operator with infinite speeds to coordinate with his rhythm of movement or selection of speed that is, in his judgment, just the exact rpm to produce his best workmanship.

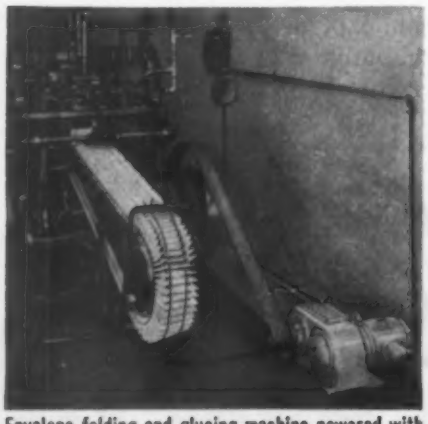
Just as an automotive engine operates at highest efficiency at a certain speed, almost any production machine or powered equipment will produce more where selectivity of motor speeds is provided. In a study of advantages created by the use of variable speeds, the manufacturers of U. S. Varidrive motors have compiled a list of applications covering diversified fields ranging from sewing machine factories to sorghum mills. From most of these interesting applications the design engineer and plant production engineer can learn of uses they can apply to their own sphere of operations.

### NO GUESSING OF MOTOR SPEED

For instance, the design engineer doesn't have to try to guess what the ultimate speed factor will be in order to be sure his machine will deliver the full optimum of production *after* installation. By installing a Varidrive motor he endows his product with speeds instead of a speed; consequently in service his machine presents an "ableness" to adapt itself to a wide range of conditions far beyond his contemplation. If a fixed speed motor operates the machine the design engineer might have guessed wrongly the speed to give it.

### REMOVING RESTRICTIONS OF SPEED

The plant production engineer need not be restricted to a set operating speed of a machine. He can, with the Varidrive, experiment with speeds to do a specific job best. For example, a conveyor may at times, when heavily loaded, require slow speed, then higher speed when the load is light, or when parts have to get to a worker's location



Envelope folding and glueing machine powered with U. S. Varidrive. For different sizes of envelope a different speed is required.

Varidrives on a mixing machine processing rotary drilling oil base. The proper mix depends on the exact speed required to blend materials.

Conveyor travel is controlled for better distribution and timing with a Varidrive. This conveyor is an automatic system for drying printed material.

## TYPICAL VARIDRIVE MOTOR TYPES

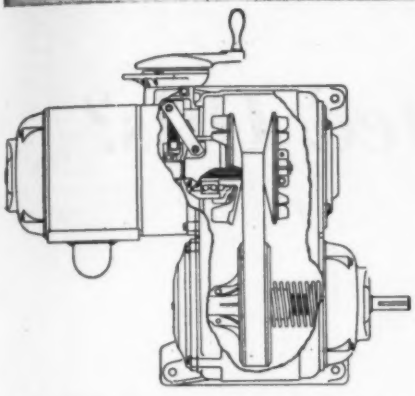
**TYPE VA—SMALL H.P.**
Low cost model, ¼ to ¾ h.p. 4 to 10,000 rpm. Ratios 10:1. 1 & 3-phase.

**TYPE VEU—GH**
Upright case with low shaft. Control dial on side.

**ELECTRIC CONTROL**
Varidrive with Type ERC heavy-duty remote control motor.

**REMOTE CONTROL**
One of many control arrangements. Control shaft can be extended.

**TYPE VE**
Horizontal case with control dial on top of motor.



**OPERATION OF A VARIDRIVE**

**By turning control dial, the diameters of the belt discs expand or contract, thus changing fixed speed of motor shaft to variable speed of the take-off shaft. Quiet, shockless, enclosed transmission.**

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faster. In cutting shafts on a lathe from large to small diameter, frequent change in speed keeps the power tool operating at a uniform lineal travel to get the job completed in the least time. With a Varidrive, the speed can be instantly changed to synchronize with each specific travel or load condition.

Machines turning out different sizes of parts can produce better with variable speeds. If work chatters, feed can be adjusted for best surface speed, longer tool life and finer workmanship.

In experimental processes involving mixing in vats under varying conditions of viscosity, temperature, homogenization or rate of agitation, variable speed plays an important role, which is impossible with a fixed speed motor. The right speed makes all the difference in getting the right mix. With Varidrive no step-cone pulleys, external gears, intermediate speed changers or connections, such as extra chains and couplings are needed. Usually a Varidrive can be direct connected to the prime driving shaft of the machine or equipment.

In pumping and hydraulic control operations variable speed is the answer. Flow, pressure, suction and load can be maintained at just the right equilibrium by a Varidrive. In some machines the exasperating problems of noise, chatter, vibration, over-heating and pulsation contribute to the shortened life of equipment, or affect the quality of the product undergoing processing. These troubles can be invariably "cured" with a Varidrive because the operator can experiment down to a split rpm to get the most sensitive speed to overcome the trouble.

### SPEEDS TO FIT TIMING FACTORS

Equipment is frequently required to complete an operation in predetermined time. Variable speed permits a step-up or step-down to establish the right production tempo. In controlling cycles of infra-red baking, drying, heating, soaking, grinding, capping, tumbling, coating, plating, etc., speed movement must be precise—or rejects will cut into profits. What, then, is more logical than to install a Varidrive to provide the nerve-center of speed regulations?

### IMPROVEMENT IN OUTPUT

In thousands of plants, the U. S. Varidrive motor has brought about amazing improvements in production. Powered machines have had their output stepped up to 30 percent or more in innumerable instances.

In general, these Varidrives can be obtained in a range of from ¼ to 50 h.p., and for speeds from 2 to 10,000 rpm in ratios of 10:1.


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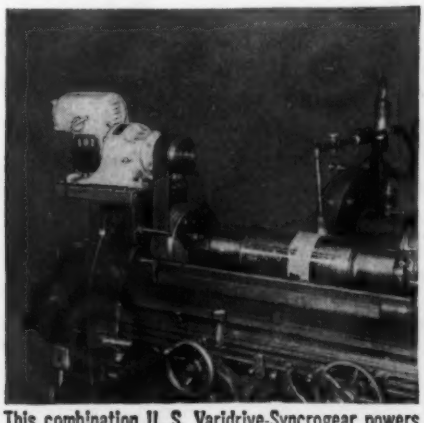
In a research laboratory this Varidrive motor operates test equipment for checking performance characteristics of water pumps.



This combination U. S. Varidrive-Syncrogear powers a special roll grinding machine for cold rolling aluminum sheets, from heavy to light gauge.

*High speed, close tolerance operation of hydraulically powered machine tools has required the development of inhibited oils. In this article you'll learn what oil properties are being improved by the use of additives. Mr. Sharpe tells how the inhibitors work, gives suggestions for the care of inhibited oils and lists the advantages of using oils which have additives.*

# Do You Need Inhibited Oils?

**By R. Q. Sharpe**

THE best way to find the answer to the question "Do you need inhibited oils?" is to ask the machine. And the machine's answer would be "yes," for it has told us so many times over.

For example, a battery of piston-casting machines had frequent shutdowns from severe valve deposits, while using straight mineral oils. With high-quality, inhibited oil there were no valve deposits after more than 2 years of service, and operating temperatures were 15 degrees F lower.

Hydraulic drills experienced jumpy action and valve deposits with straight mineral oil, but ran smoothly—with no valve deposits, when converted to inhibited oils.

With straight mineral oil in service, a group of vertical, hydraulically-actuated lathes developed severe deposits, filter clogging and frequent shutdowns for cleaning purposes. By merely cleaning the system and installing an inhibited oil, no deposits have been formed after more than two years of service.

Numerous examples could also be cited of reduction of wear and rusting, by changing from straight mineral to inhibited oils. The purpose of this article will be to try and show why such improved results are obtained, especially in industrial hydraulic machines.

## *Desirable Hydraulic Oil Properties*

To properly measure the value and advantages of inhibited hydraulic oils, we must know the properties needed in a suitable hydraulic oil. Then we can determine the influence of inhibitors on these characteristics.

In summarizing in Table 1, the most desirable hy-

**TABLE 1**

| Oil Property | Benefit To Hydraulic System |
|---|---|
| Proper Viscosity | To seal pump and valve elements against internal leakage. To flow readily through valves and lines. Reduce fluid friction. |
| High Viscosity Index | From room to operating temperature, to provide the most practicable unform rate of flow through valves, pumps and lines. This means more uniform product output. |
| High Oxidation Stability | Minimum deposit formation in valves and pumps. Continuous operation. Provides low maintenance and long oil life. |
| Good Film Strength (Anti-wear characteristic) | Low wear of pump and valve parts. Helps maintain "new machine performance." Low maintenance. |
| Good Rust Protection | Prevents rusting. Low maintenance. Lengthens life of pump, valves and oil. |
| High Resistance to Foaming | Minimum foam formation. Gives smoother machine performance. Lengthens pump life. |
| Good Demulsibility | Ready separation from water. Reduces deposit formation. |

*R. Q. SHARPE, Staff Engineer, Industrial Division, Socony-Vacuum Oil Company, New York, N. Y.*

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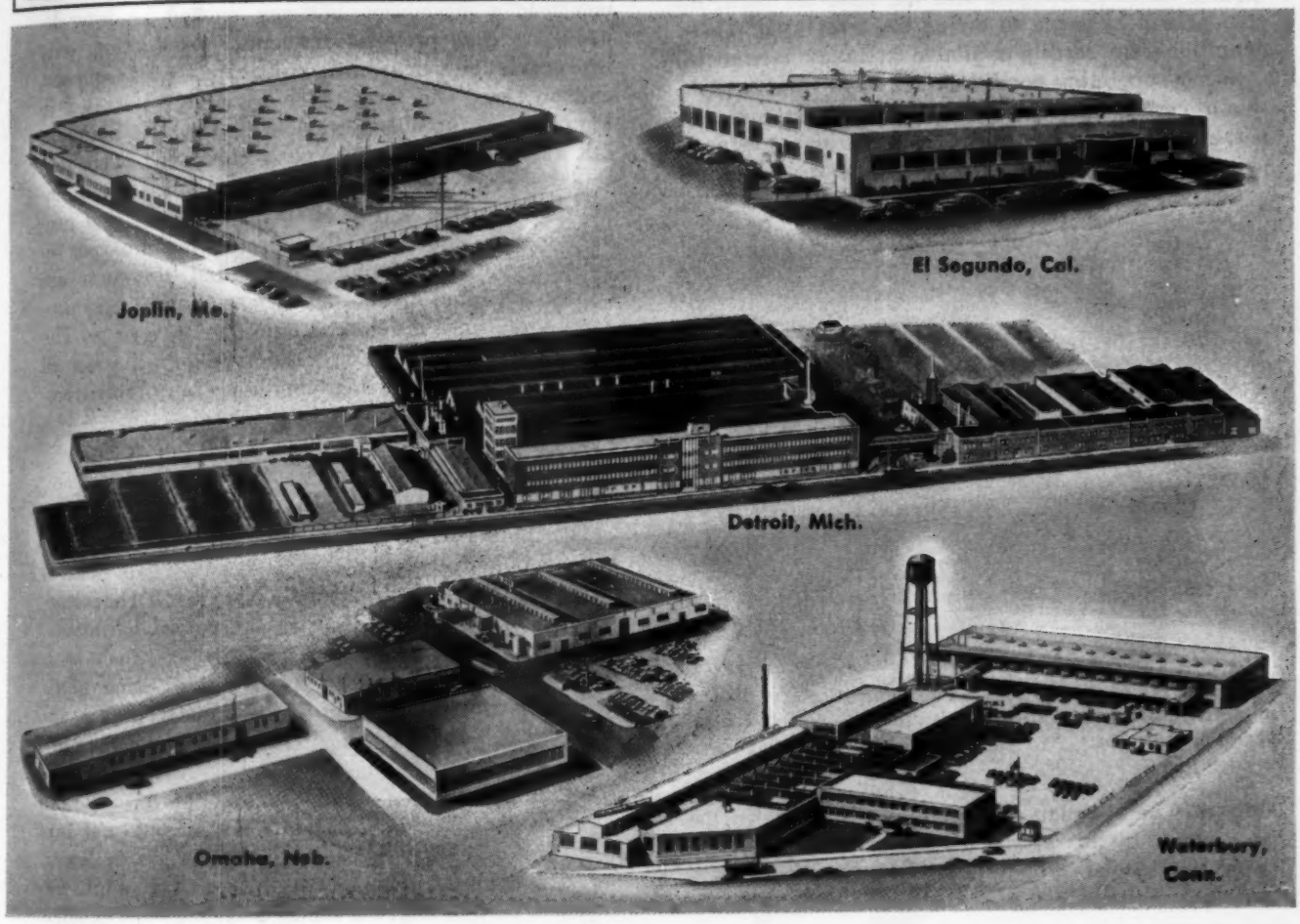


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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

draulic oil characteristics and the need for each, no attempt will be made to define the term used. These definitions are readily available in many references.

Special operating conditions may call for examination of certain other properties. For example, low temperature starting may call for an oil having a low pour point. However, oil viscosity at the starting temperature may be of equal, or greater, importance than the pour point. In this article no effort will be made to cover the special properties required to meet such unusual conditions.

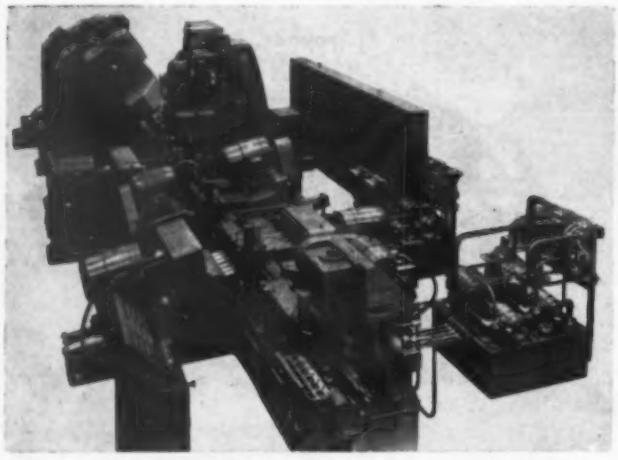


**FIG. 1. This station-type transfer machine typifies a modern multiple-operation, hydraulically actuated high production unit.**

## *Suitability of Straight-Mineral Oils in Hydraulic Systems*

Of course, the characteristics outlined are possessed to some extent by high-quality, straight-mineral oils. Therefore, such products were used successfully in hydraulic systems during the early years of hydraulic actuation. In these machines circuits were simple. With simple circuits and few critical operations, such as in tracing or station type machines, high viscosity index was of less importance. Hydraulic valves were mostly hand or mechanically operated and ample power was available to break them loose when stuck by gummy, resinous deposits. This, and the use of fewer multi-step hydraulic cycles demanded less from the oil in oxidation stability or freedom from deposits. Pump and valve wear was higher than with good inhibited oils, but were taken as a matter of course. The resulting production loss during repairs was accepted as inevitable.

Rusting problems were not too numerous with high-quality straight mineral oils. In service these products develop natural rust inhibitors that are reasonably effective. However, rusting would occur if severe contamination from soluble oil or water was experienced.

The foaming and demulsibility properties of high-quality, straight-mineral oils were fully satisfactory.

## *Need for Inhibited Oils*

Today, the use of many hydraulic machines or elements in a production line has created an inter-dependence that provides maximum production only when each unit performs its task correctly, in sequence, and on time. The station-type machine, illustrated in Fig. 1, is an excellent example of this. To maintain full output of such units, valves must stay clean, and original pump and valve clearances must be maintained. The same is true of single machines in a production line, and especially those having multiple sequences in the operating cycle. Often, pressures are higher, machines operate more continuously, and production demands are greater than they used to be. The best insurance that the hydraulic system will meet all these needs is to use high-quality oils suitably reinforced with proper inhibitors.

## *Which Oil Properties Will Inhibitors Help?*

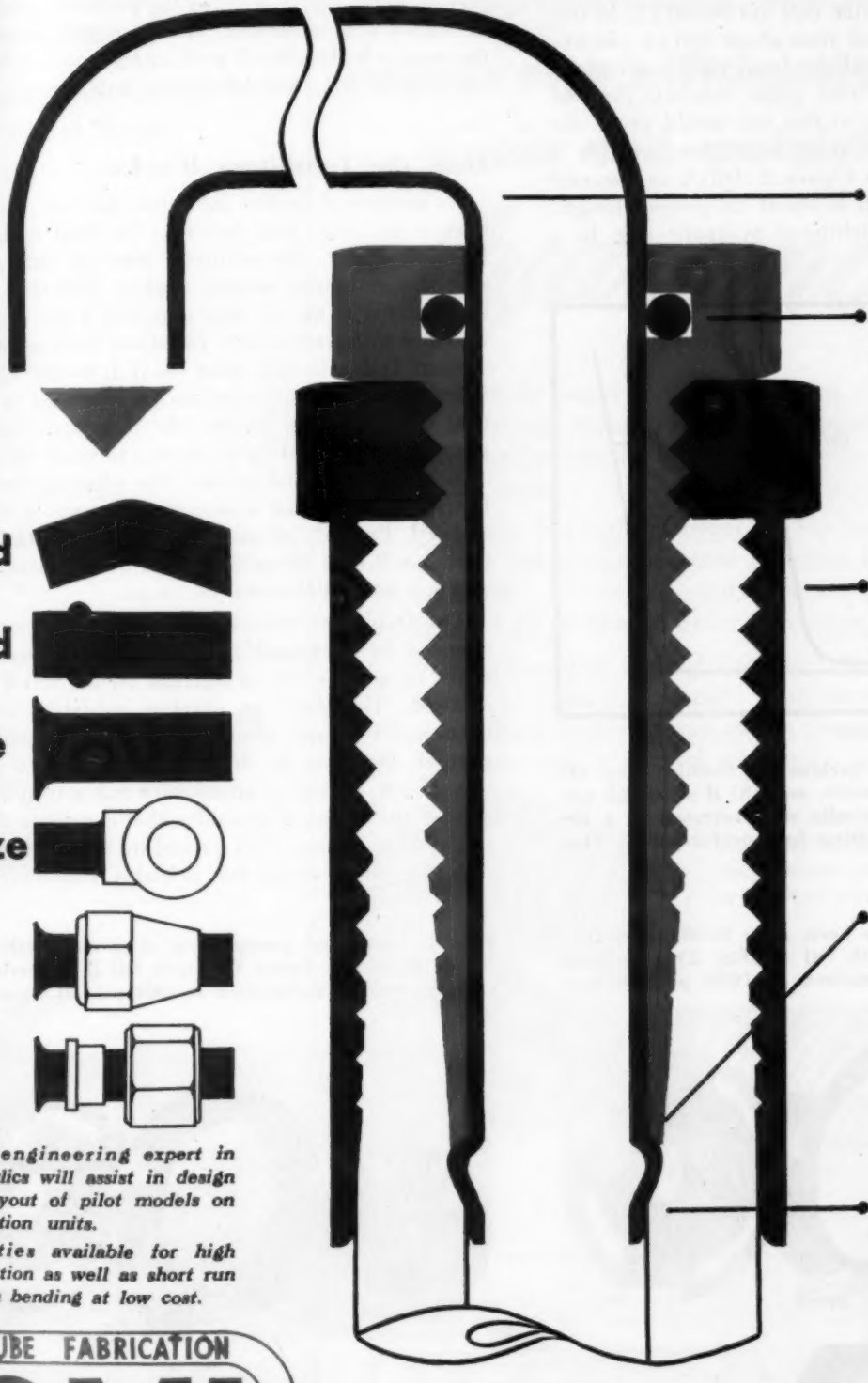
The inhibitors, or additives, we speak of are chemical compounds designed to supplement certain natural properties of the hydraulic oil. Not all oil characteristics can be improved through the use of inhibitors. For example, the viscosity of an oil at any given temperature is not deliberately changed by using additives. It is true that certain additive materials will increase or decrease oil viscosity, but that is not the purpose for which they are added. Also, oil demulsibility is best improved by a proper combination of crude oil selection and refining. Inhibitors not only do not improve this property, but some inhibitors act to lower the demulsibility. However, inhibitors or additives are often used to improve the oil properties of viscosity index, oxidation stability, film strength or anti-wear characteristics, rust protection and foam resistance.

Great skill is required in the application of additives to oil, because of the complex chemical structures of both. Some oils respond very well to certain inhibitors and very poorly to others. Or an oil may respond very well to inhibitors, but be basically unstable, so when the inhibitor is used up the oil fails quickly. An inhibitor that definitely improves one property of an oil may adversely affect another characteristic. For example, certain additives improve the film strength of an oil, but lower the demulsibility. Rust inhibitors often have the same effect.

To accurately measure the relative effect of inhibitors, much attention has been given to suitable laboratory tests, and many have been devised. Some tests are accurately reproducible, while others are not. For example, several tests are used for measuring the film strength of oils, but the results can neither be accurately reproduced nor correlated with field performance. Therefore, while the refiner may screen certain oil properties in his laboratory, their real value can be determined only by field testing.

The variation in laboratory test results may easily be demonstrated. One test used in the laboratory for measuring the induction period of an oxidation inhibitor is the ASTM Test for Oxidation Characteristics

# maeward STEMLOK coupling



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of Inhibited Steam-Turbine Oils (D 943-47T). In this test a straight-mineral oil runs about 100 to 150 hr., whereas inhibited oils will run from 150 to as high as several thousand hours. One might conclude that the oil that ran the longest in this test would prove the most stable performance in the field. However, this is not necessarily true. In Figure 2, Oil A ran several thousand hours, and Oil B about 25 percent longer. Both are high-quality, inhibited hydraulic oils. In a hydraulic pump test, closely simulating and correlating with field performance, exactly opposite results were secured with the same two oils. Figure 3 shows the pump and valve parts after 2500 hr with Oil A in service while Figure 4 shows the parts after only 1600 hr with Oil B in service. This is a good example of the reason hydraulic-oil performance cannot be accurately predicted from laboratory tests alone.

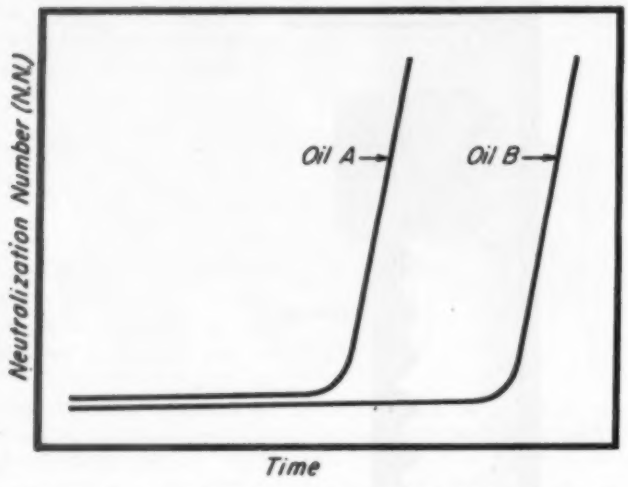



**FIG. 2. In the A.S.T.M. Turbine Oil Stability Test. Oil A ran several thousand hours, and Oil B about 25 percent longer. But, these results were reversed in a Hydraulic Pump Test simulating field performance (Figs. 3 and 4).**

## *How the Inhibitors Work*

As mentioned earlier, inhibitors are not used to influence viscosity, but they may be used to improve Viscosity Index. The additives used for this purpose are high-molecular weight organic materials which, when added to the oil help maintain a more constant viscosity with temperature variation. Such additives in aircraft hydraulic oils raise the V.I. to 200 or more. Viscosity index improvers are seldom used in industrial hydraulic oils, because the long-chain molecules are quickly chopped up in passing through the narrow orifices of valves and pumps. The resulting loss of effectiveness may cause a drop of 25 percent in viscosity and V.I. Properly processed industrial hydraulic oils, having a V.I. of about 90, perform very satisfactorily within a normal temperature range.

The Oxidation Stability of an oil is adversely influenced by increased temperature, the presence of water or soluble oil, or various metals which act as catalysts. Therefore, an effective oxidation inhibitor must nullify these effects as much as possible. In general, this may be done in either of two general ways. First, the use of an additive that acts to halt and reverse the chemical reactions that constitute the first stages of oxidation. This procedure is very dependent upon the use of an oil that is highly responsive to the

**FIG. 3. Valve and pump parts after 2500 hours in a Hydraulic Pump Test with Oil A (Fig. 2) in service. Operating pressure maintained at 1000 psi, oil temperature at 175 F.**

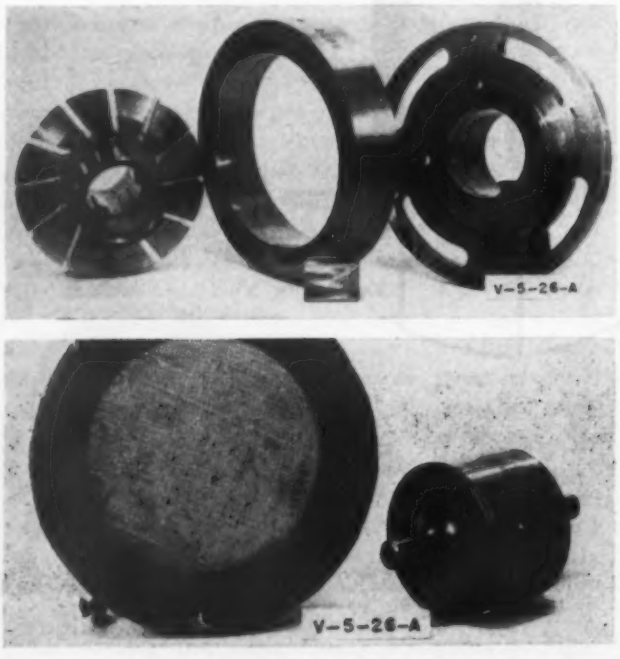
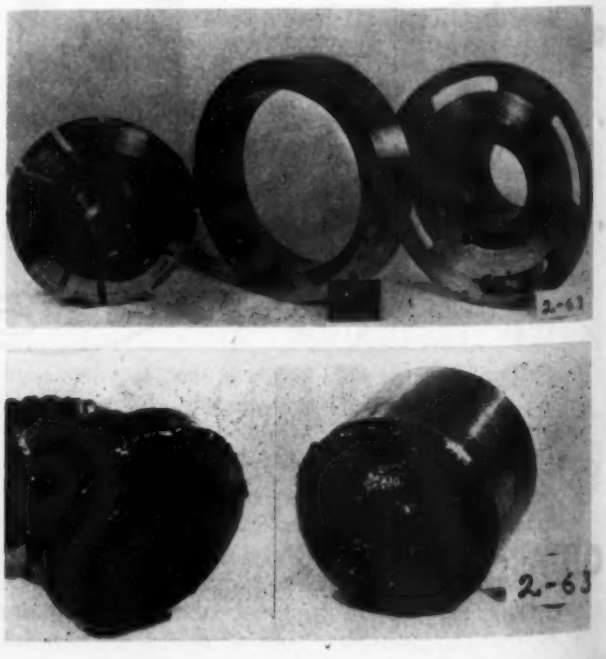
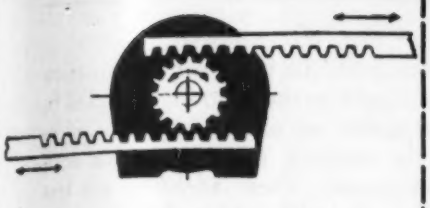



**FIG. 4. Valve and pump parts after only 1600 hours in the Hydraulic Pump Test with Oil B in service. Operating pressure maintained at 1000 psi, oil temperature at 175 F.**





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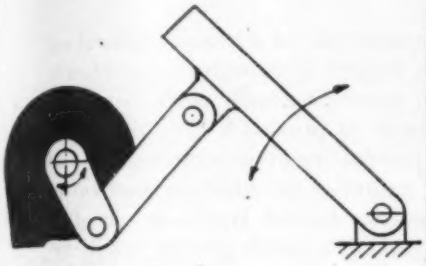
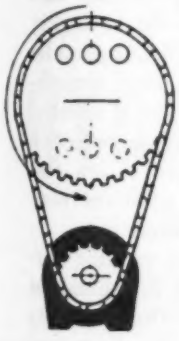
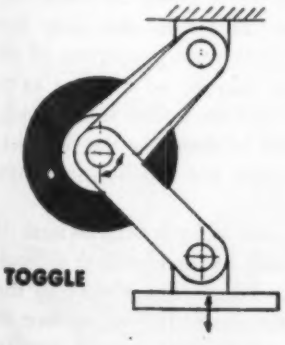


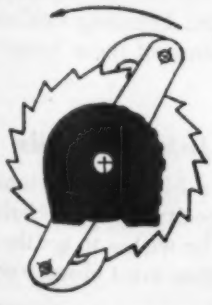
LIFTING



FIXTURE
POSITIONING
OR
INDEXING



TOGGLE



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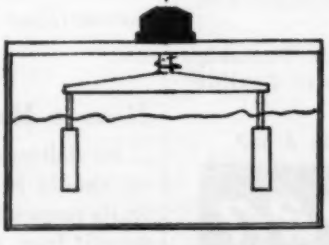
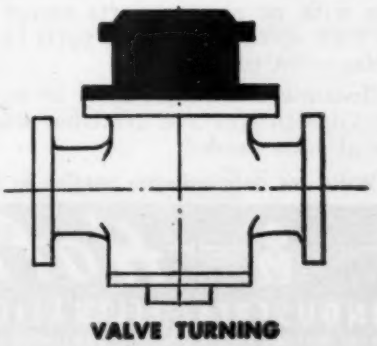


MIXING OR AGITATION
(OSCILLATING ACTION)



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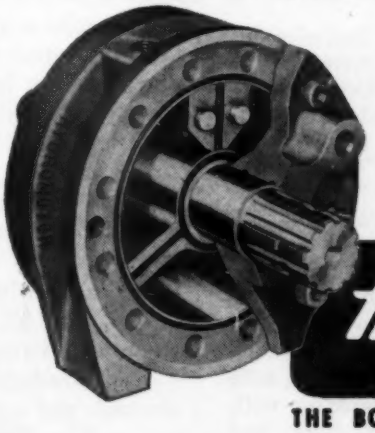

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## Do You Need Inhibited Oils?

additive or additives used. An improper combination may result in deposits such as shown in Figure 4, Oil B. The second method makes use of an additive or additives that reduce the catalytic effect of metals with which the oil is in contact. These additives are less selective toward the oils with which they may be used, and are particularly effective at high temperatures. Both methods act to minimize deposits in valves and pumps, as well as to increase the service life of the oil. Greater production output and lower ultimate oil costs should result.

The anti-wear characteristic of a straight-mineral oil may be considerably improved through the use of suitable additives. Such materials usually react chemically with the metal surfaces to provide a film of metallic soaps which helps prevent metal-to-metal contact and resultant wear. The nature of the additives used varies with the degree of activity desired. Hydraulic oils often employ chemical compounds which provide mildly reactive, non-corrosive films that are effective in providing low pump and valve wear. At the other extreme heavy-duty gear lubricants often use sulpho-chlorinated compounds that are very active chemically and sometimes corrosive. Such products would be highly undesirable in a hydraulic system. When hydraulic fluids are used to lubricate machine tool ways, smoother performance is obtained through the use of selected oiliness additives. These oils are especially effective in providing smooth table-way movement at low traverse speeds. Improper film-strength additives may cause deposit formation in close clearances.

Rust inhibitors preferentially wet the metallic surfaces in contact with the oil, providing a thin film that prevents water from reaching the metal. The inhibitors used for this purpose are chemical compounds that attach themselves to metals to form polar or mildly reactive chemical films. Rust inhibitors also may improve the film strength or anti-wear properties of an oil. Improper rust-inhibitors may be so reactive as to be corrosive to non-ferrous metals under some conditions. All rust-inhibitors tend to decrease the demulsibility of the oil, although some are much worse than others in this regard.

The introduction of air into a hydraulic system is unusual, and normally caused by mechanical difficulties such as suction line air leaks. The ability of the oil to quickly release air bubbles at the oil surface in the reservoir is a function of the nature and quality of the oil and its additives, extent of contamination, oil condition and reservoir design. Foaming can readily be controlled by a proper balance of these items.

### *How to Maintain Your Inhibited Oils*

As delivered to the plant, a high-quality, inhibited oil should be of suitable viscosity, properly balanced in its properties and clean. If he wishes to get the most benefit from the oil, the user then must observe certain simple precautions.

Give the oil a clean home. Use clean containers to transfer it from the storeroom to the machine. Make

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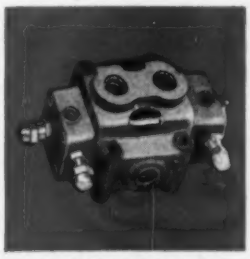

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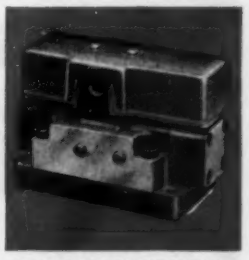

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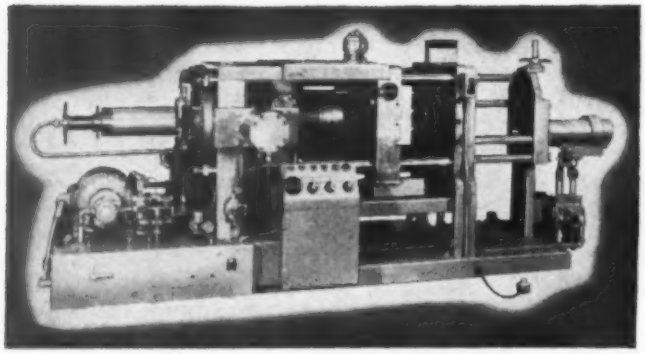

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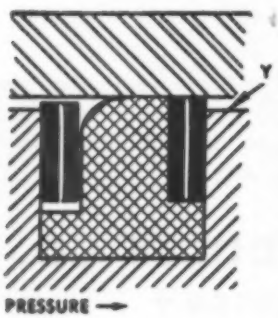


As pressure is applied, conventional packings soon extrude into clearance space Y, then fail. Not so the G-T Ring! Because of its design consisting of a resilient sealing ring in a T-Section supported on each side by two non-extrusion rings, it cannot extrude. As pressure is applied to the G-T Ring, the resilient material flows under the non-extrusion rings, urging them against the cylinder wall and blocking the path of extrusion.

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sure that the machine is clean before the new oil is put in. Use gasketed covers on the reservoir whenever possible, and keep them tight. Plug other openings into the reservoir to prevent the entry of soluble oil, dirt or other contaminants. Use a large air vent—fitted with an air filter if the atmosphere is dusty.

Keep the oil clean. The oil should be filtered, on a scheduled basis, depending on the degree of contamination. Depending on the number of hydraulic systems and other factors, this may be a continuous by-pass, portable by-pass or batch type of filter. Activated clay filters should not be used, since they will remove substantial percentages of the additives you have paid to have placed in the oil. Other filtering media, or methods, will do an effective job of purifying the oil if properly selected for the conditions involved.

Keep the operating temperatures low. The oxidation rate of an oil doubles with every 18 F rise in temperature. Therefore, if you lower the temperature of your hydraulic oil from 148 F to 130 F you have doubled your oil life—if you can keep it clean. The JIC (Joint Industry Conference) Hydraulic Standard recommends a maximum reservoir temperature of 130 F. You will have longer oil life, fewer deposits and greater production if temperatures can be kept down to this approximate level. This may usually be accomplished by proper circuit design, suitable pump capacity and reservoir design, lowest practicable operating pressure, or the installation of a suitable oil cooler.

### *Benefits to be Gained from Inhibited Oils*

The advantage of inhibited oils as compared to straight-mineral oils will vary widely, of course, because there is a wide range of quality in both. An inhibited oil of low quality with an insufficient amount or improper selections of additives may actually be inferior to a high-quality straight-mineral oil. However, comparing a high-quality inhibited oil with a high-quality straight-mineral oil, properly cared for, the following benefits may be anticipated.

*Longer Oil Life*—Greater resistance to oxidation, and the damaging influence of complaints.

*Greater Production Output*—More continuous and smoother machine operation.

*Decreased Maintenance*—Less wear of pump and valve parts. Cleaner valves with less frequent cleaning.

*Lower Oil Cost*—As measured over the life of the oil charge, and considering the above benefits.

Yes, you *do* need inhibited oils!

---

*All papers presented this month at the 9th National Conference on Industrial Hydraulics will be published in booklet form by the sponsoring societies. You'll be able to order it early in 1954. Copies of the proceedings for last year's meeting are still available.*



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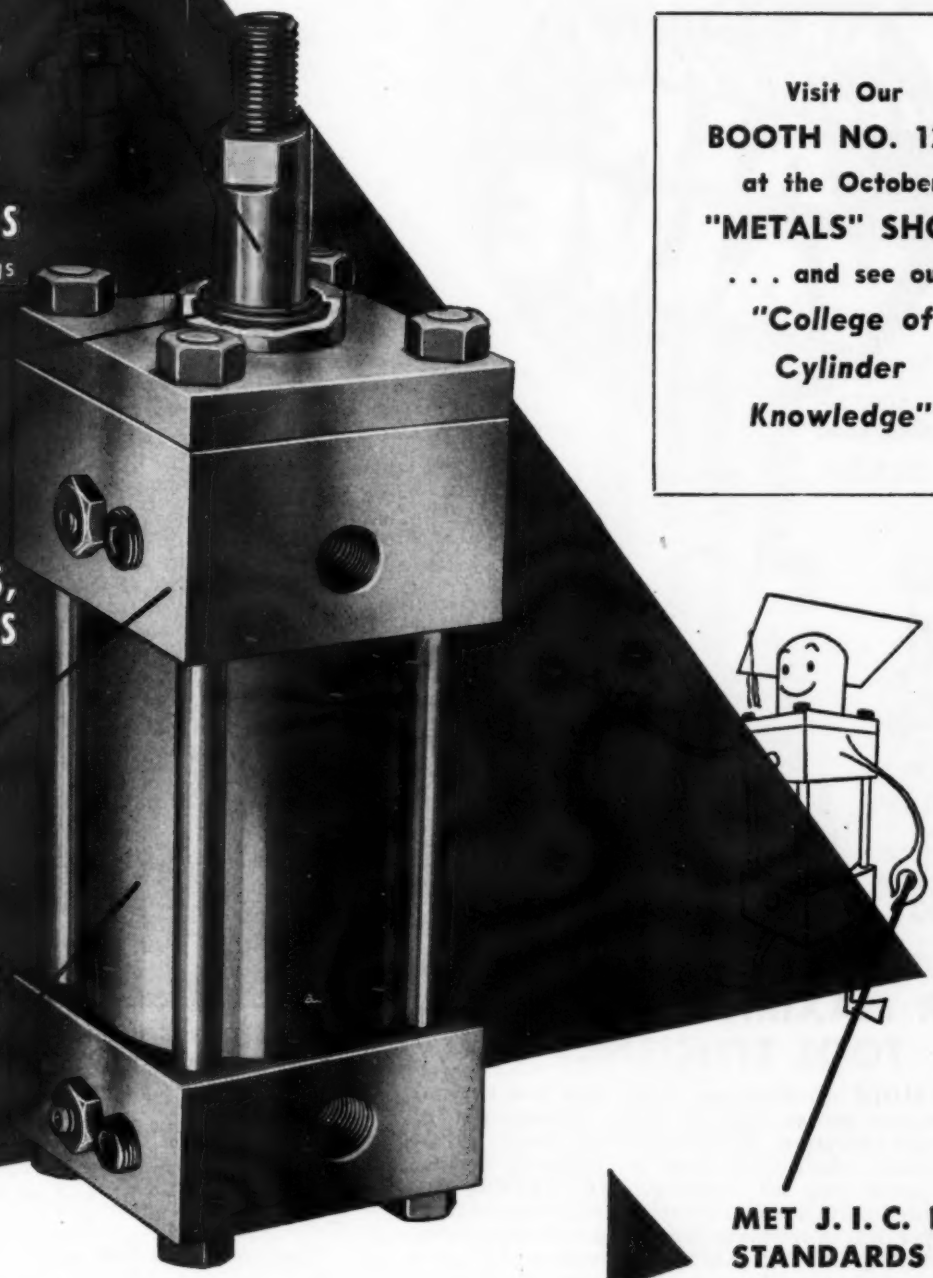

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Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

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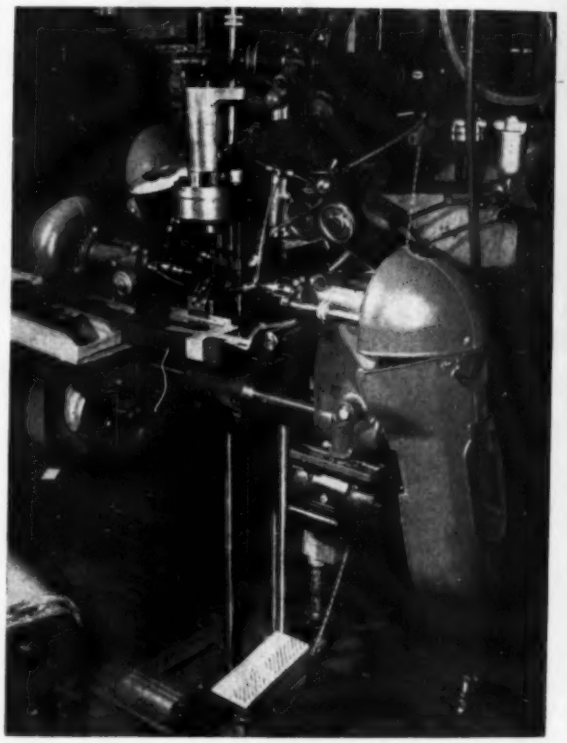
# One Air Feed Unit for Three Drill Heads

HERE'S a tooling set-up which will interest production men who want to speed up drilling operations without using special drilling heads or complicated fixtures.

At the Ansco Camera Works, Binghamton, N.Y. methods engineers were given the project of selecting equipment for a delicate small hole drilling job. The work piece was a camera flash unit housing. Four small holes had to be drilled in three different sides.

When the job was first set up, the work was placed in a tumbling jig and moved between three separate drill presses. This was a slow way to do the job. To speed up the operation and still maintain the quality



**FOOT CONTROL actuates the air feed. With cables and pinion pulleys to transmit spindle movement, all three heads approach the work together.**

*Courtesy The Bellows Co.*

of a careful, slow hand-fed operation, one of Ansco's methods engineers worked out the tooling set-up shown in the photograph.

Starting with a floor model drill press, the engineer added 2 drill heads mounted horizontally. A simple, easily loaded jig replaced the tumbling jig. Suitable trays were provided for stock.

That's where the air powered drill press feed entered the picture. A foot control actuates the feed, and with cables and pinion pulleys to transmit spindle movement, all three heads approach the work simultaneously. As the spindles retract, exhaust air removes chips promptly to keep the work clean.

With one drill press feed, four holes are precision drilled, clean and fast. In an average 8 hour shift, where 585 parts handled had been normal, production now totals 4000 parts, each with four holes.



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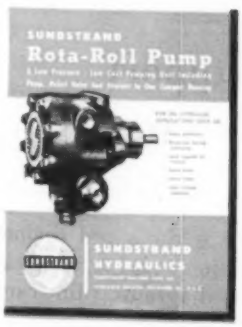


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*Based on motor speed of 1725 rpm and 100 psi.

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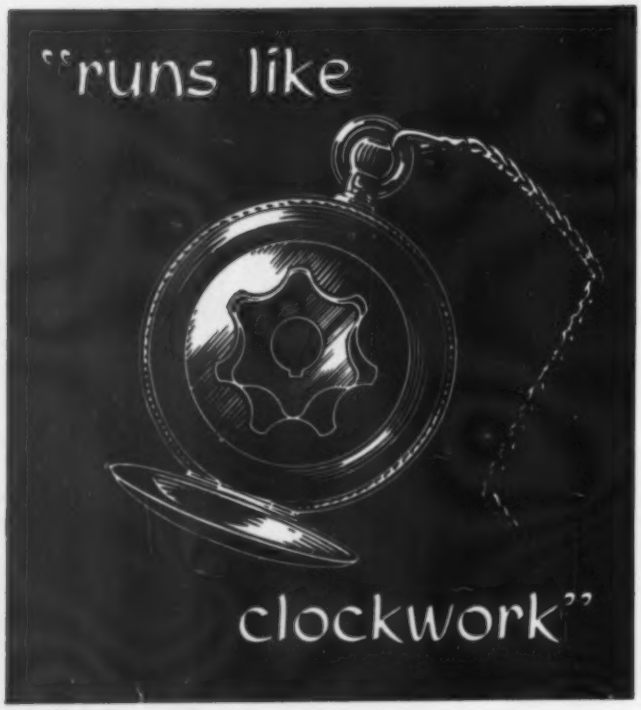
the GEROTOR mechanism

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*Gerotor May Corp. . . . Baltimore 3, Md.*

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**HYDRAULIC PUMPS & FLUID MOTORS**

# Oil Power Handles Larger Loads

Concluded from page 72

psi each motor takes 14.5 gpm to rotate at 1190 rpm. Connected in parallel, the motors are supplied by a variable volume vane pump having a maximum capacity of 29 gpm at 600 psi. A hand wheel adjustment on the pump changes the pump delivery to vary the dirt lift wheel speed and power as required. In an emergency, this pump can replace the double gear pump to power the other hydraulic units. Hose lines and control valves are arranged to permit this changeover at any time.

Selection of the drive for the dirt lift wheel was based on a load analysis which included the weight of the wheel and the wheel load. It was figured so that the maximum load could be carried with a friction factor as low as .106. The ring rests on and is friction driven by rollers which are driven by the fluid motors.

### *Air Circuit*

Air power is used on the ballast cleaner to actuate the brake and clutch on the drive. Figure 7 shows this air circuit. Air is taken from a storage tank which is supplied by the air compressor. A manually operated brake valve controls air flow to the brake cylinder and regulates brake pressure from 0 to 80 psi. A regulator in the clutch line limits operating pressure to 45 psi. Quick release valves will open to exhaust air upon release of the brake or clutch.

Development of this ballast cleaner and winch car team has been made to assure operating flexibility, simplicity, low cost and easy maintenance. The application of oil and air components plays an important part in attaining these goals.

---

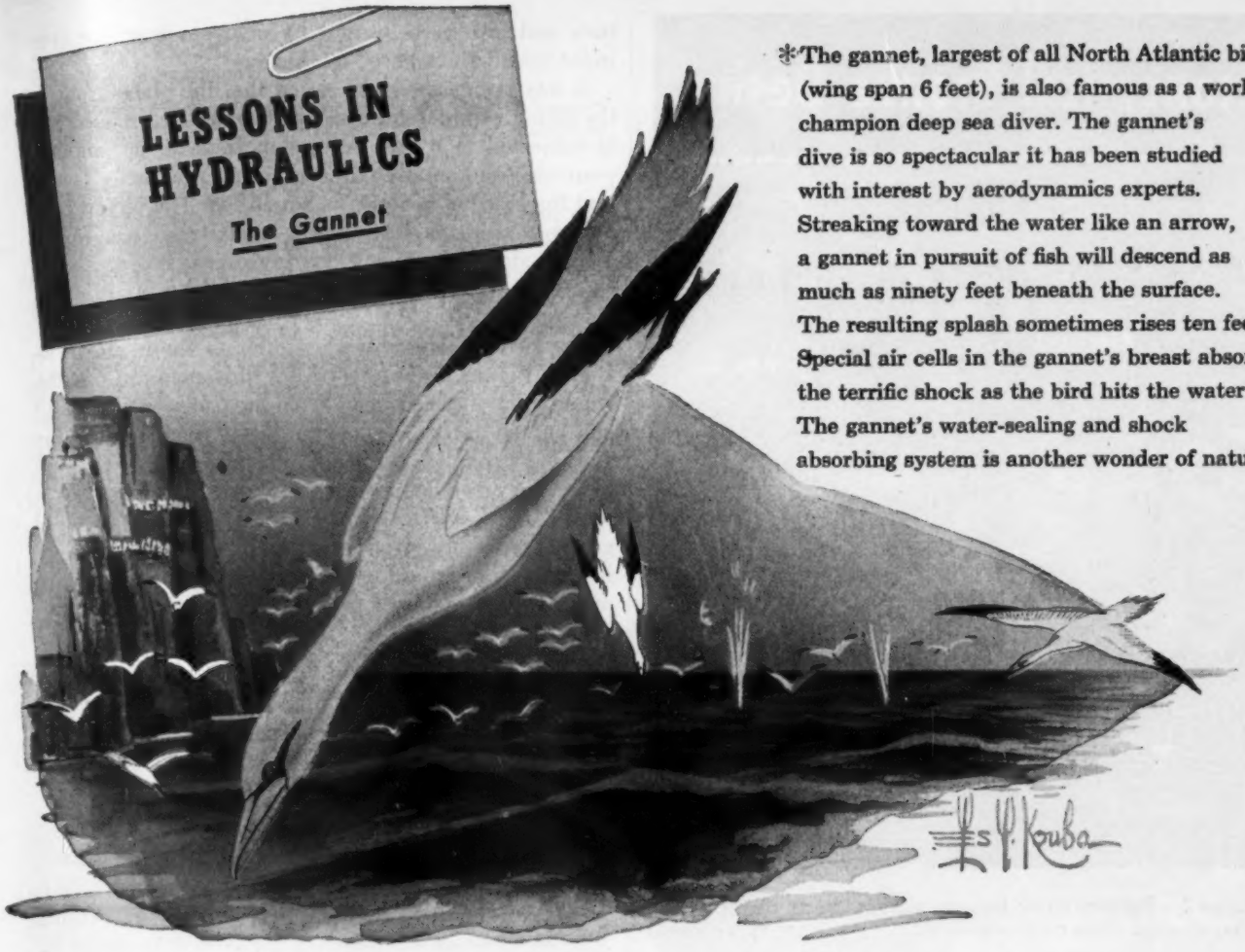
# How to Support Long Stroke Cylinders

Concluded from page 69

cations it is first necessary to select a rod diameter which has an "L" in the tabulation equal to, or greater than, the "L" in the mounting diagrams (dimensions inserted) for the required thrust.

Additional side support is required when "L" is more than 40 inches. To get this added side support a longer stroke cylinder is used and the extended piston rod position is restricted with a stop tube. One inch of stop tube is recommended for each 10 inches of "L" length over 40 inches. The stop tube increases the rigidity of the cylinder assembly when the rod is extended.

The selection of stop tube length can be made by using the data given in Figure 4. This method was determined by mathematical force analysis of loading




*The gannet, largest of all North Atlantic birds (wing span 6 feet), is also famous as a world champion deep sea diver. The gannet's dive is so spectacular it has been studied with interest by aerodynamics experts. Streaking toward the water like an arrow, a gannet in pursuit of fish will descend as much as ninety feet beneath the surface. The resulting splash sometimes rises ten feet. Special air cells in the gannet's breast absorb the terrific shock as the bird hits the water. The gannet's water-sealing and shock absorbing system is another wonder of nature.

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**Series IV—Rubber impeller bronze pumps**
Oilless bearings 6-21 G.P.M.—0-30 P.S.I. $16.00-$28.00 (three pumps)

**Series 55—Standard bronze rotary gear pumps**
Grease fittings 2-23 G.P.M.—0-100 P.S.I. $11.25-$29.00 (twelve pumps)

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Grease fittings 2-25 G.P.M.—2-10 P.S.I. $9.25-$24.00 (three pumps)

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tests and proven successful by many long stroke cylinder installations based on this data.

It has been previously stated that the piston rod of the tilting cylinder for the Whiting electric arc furnace is subjected to a pull or tension force to accomplish pouring. Column strength, or buckling is not a factor and the loading problem is simplified. The piston rod, however operates horizontally and its weight would exert a side pressure on bearing areas. Incorporation of a stop tube in the cylinder would then reduce the side pressure.

The design aspects were similar to those shown as P-3 in Figure 4. Total "L" for this mounting is the summation of the distance from the trunnion to the rod end in the retracted position 41-¼ inches, plus the working stroke of 68 inches, plus the length of the supplementary rod extension 50-¾ inches. This gives a total "L" of 160 inches. On this application 160—40 gives 120 inches. Dividing 120 by 10 indicates a 12 inch stop tube would be satisfactory. The cylinder was made 12 inches longer to accommodate the stop tube.

---

# *Hydraulic Winch to the Rescue*

DEVELOPMENT of a hydraulically operated winch as standard equipment on service helicopters has added to the usefulness of the already versatile "choppers" or "windmills". To the reconnaisance, freighting, particularly by sling, of food, medical personnel and supplies and emergency ammunition supplies, the hydraulic winch has extended the range of rescue work by making it possible for injured or nearly exhausted personnel to be transferred or rescued. Rescue operations, whether from the sea or from enemy held areas, have become routine.

**FIG. 1. A RESCUE at sea by a Piasecki HUP equipped with a hydraulic winch.**

Prior to 1944 the transfer of personnel from the ground or the surface of the sea to the helicopter in flight was by means of ropes or rope ladders. The idea of a power-driven rescue winch and harness was

## Hydraulic Winch to the Rescue

Continued

originated in the U. S. Coast Guard—credit is especially due to Captain (then Commander) Frank A. Erickson, USCG—where such tests were first made in the summer of 1944.

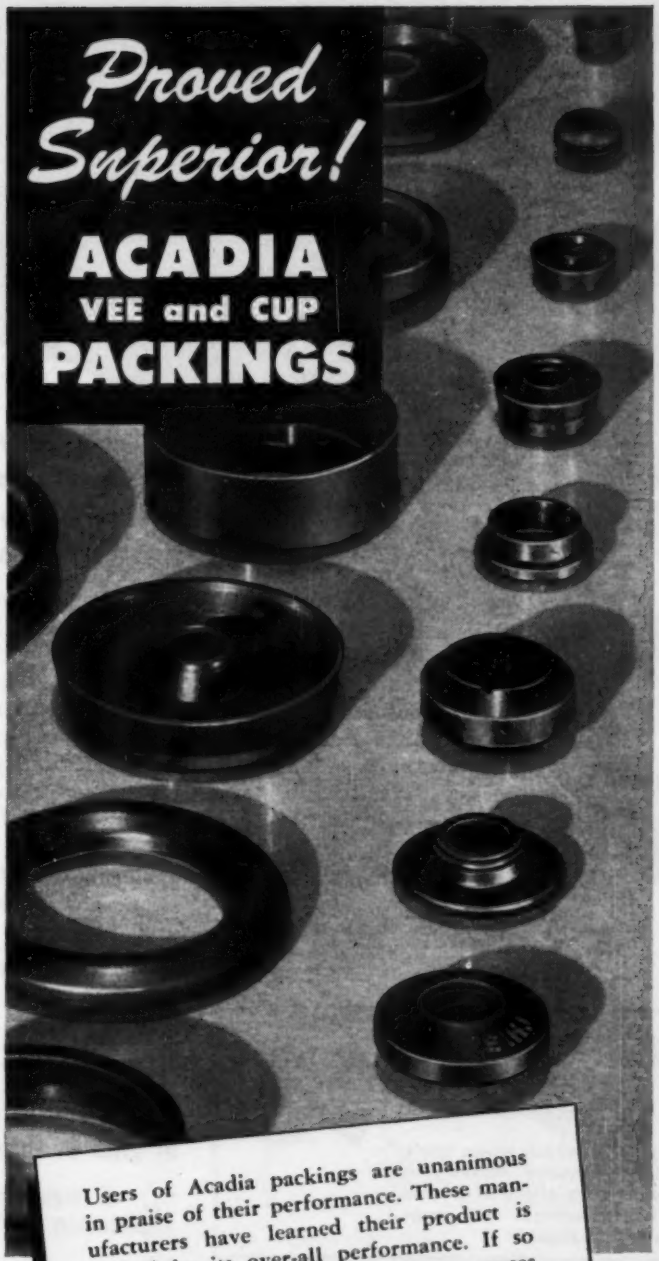
The interest of the Navy was attracted in 1947, when D. D. (Jimmy) Viner, Sikorsky's chief pilot, attached to the carrier "Roosevelt" pulled six men from the water in a matter of a few minutes. Since then the Navy has not been without carrier helicopters. In the summer of 1952, helicopters rescued 62 of 63 men who leaped from the carrier "Boxer's" flaming hangar deck off Korea. In December four Piasecki HUP's from the carriers "Midway" and "Leyte" removed fifteen men, including the skipper, from the distressed refrigerator ship "Grommet Reefer" off Leghorn, Italy.

The record ashore has been just as impressive. In Korea they have cut many critical hours off the handling time of casualties both from aid stations to rear area hospitals and from hospital ships to air strips. The Army record of 97 and a quarter percent survivals

**FIG. 2. THE RESCUE winch, with cover plate removed to show the worm and gear reel drive. The constant displacement, piston type hydraulic motor is shown at the right.**

of wounded and 85 per cent returns to duty owe a fair share of this record to the helicopters used by medical air evacuation units.

The 40 to 1 gear ratio winch, capable of lifting 400 pounds at a rate of 2-½ feet per second, is powered by a constant displacement piston type hydraulic motor which drives a helical worm meshed with the reel drive gear. A solenoid operated, aircraft type, four-way valve controls the direction of oil flow through the motor and the direction of rotation of the reel. With the valve in its neutral position the reel is locked against rotation regardless of normal load conditions. The unit may be operated continuously, intermittently, it may be reversed instantaneously or stalled without damage. The circuit contains a reservoir assembly which includes a pressure relief valve and integral filter. The unit is driven by an engine mounted hydraulic pump.


Users of Acadia packings are unanimous in praise of their performance. These manufacturers have learned their product is judged by its over-all performance. If so small a component as a packing causes trouble and must be replaced too soon, the entire unit is condemned. So join the ever-increasing list of builders of hydraulic equipment who standardize on Acadia Packings. A complete line is available. Acadia packings are molded from highest grade synthetic rubber compounds that meet a wide range of applications. Sizes: Vee rings 3-16" i.d. to 24" i.d.: single acting cups available from 5-16" to 15⅜" o.d. Write for new Acadia Packing booklet giving essential facts about physical properties, designs and applications. Acadia engineers will be happy to cooperate.

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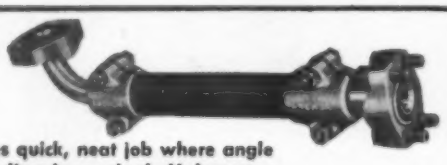
## Revolutionary Split-flange clamp eliminates threaded joints, provides perfect seal

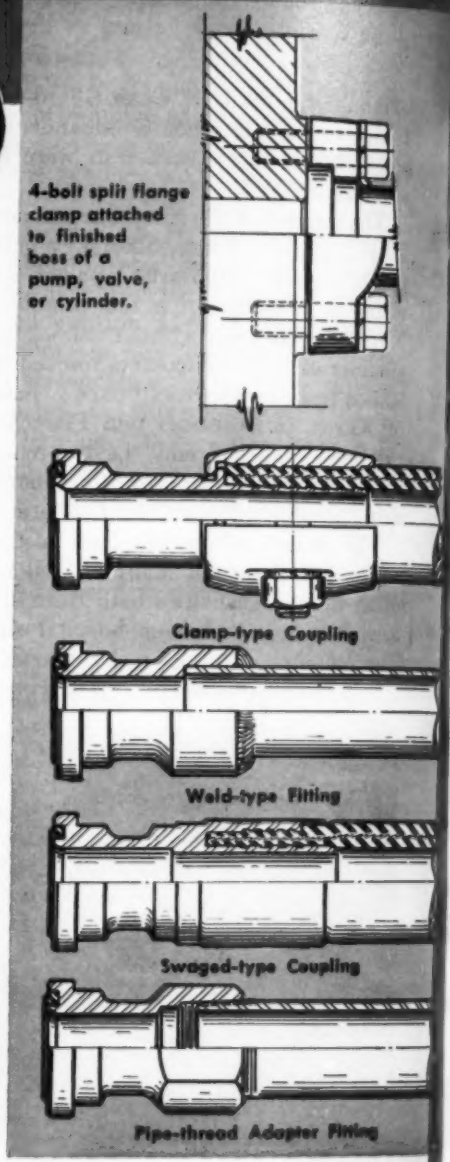
Anchor's new split-flange clamp is unusually versatile. It's SAE approved — you'll find it listed in the 1952 SAE handbook. Available for use with clamp-type hose coupling for production or emergency field service, permanently attached swaged-type coupling, weld-type fitting for steel tubing and iron pipe, and rigid pipe thread adapter fittings. Its flexibility lets you connect hose to tubing to pipe or any combination of these — simplifies assembly on all kinds of jobs. Here's why:

- ☆ Easy to assemble with small automotive-type wrench
- ☆ Ideal where clearances are limited
- ☆ Leak-proof — utilizes the "O" ring seal



Does quick, neat job where angle coupling is required. Makes your job easier with plenty of wrench and bolt clearance. Full range of angles available.

- ☆ Reusable — can be used over and over
- ☆ Eliminates stresses and strains caused by wedging action of pipe threads
- ☆ A size and type for every application — ½" ID to 2½" ID


4-bolt split flange clamp attached to finished boss of a pump, valve, or cylinder.
Clamp-type Coupling
Weld-type Fitting
Swaged-type Coupling
Pipe-thread Adapter Fitting

### Exclusive Anchor Ductile sleeve hose couplings for extra safety, extra dependability

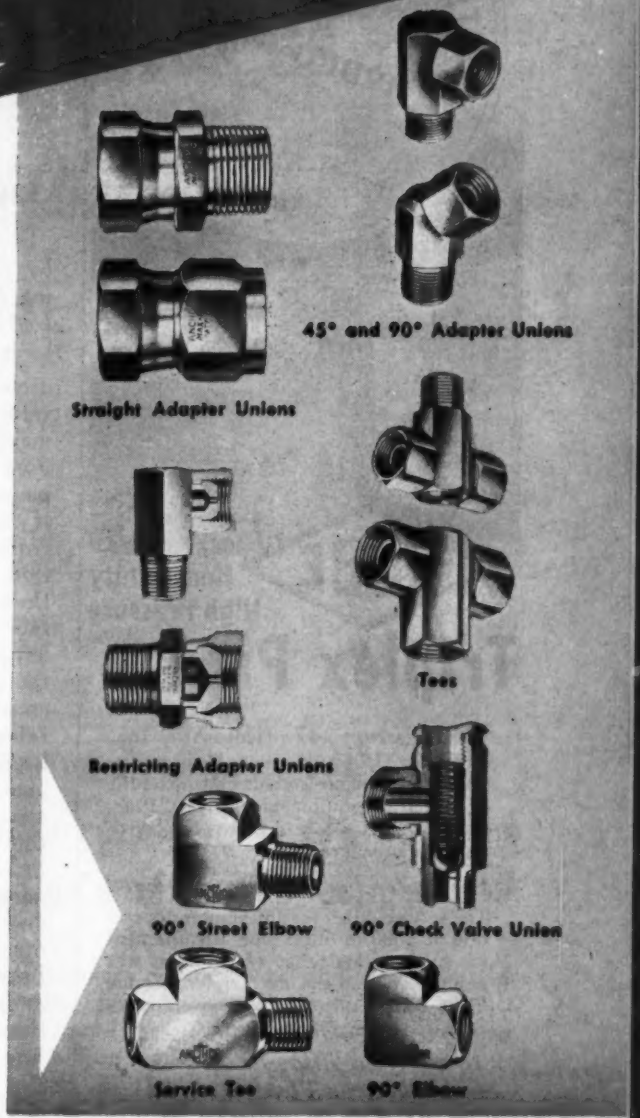
- ☆ Designed for high pressure wire braid hose
- ☆ Exclusive grip virtually makes coupling part of reinforcing wire of hose
- ☆ No leakage—no blow-offs, even under extreme pressures
- ☆ Factory assembled
- ☆ Made of steel for strength and maximum capacity
- ☆ Milled hex coupling body for compactness
- ☆ Provides positive seal of the synthetic inner tube of the hose

### Anchor clamp-type reusable couplings offer qui easy assembly, powerful grip without special to

- ☆ Designed for one- or two-braid high-pressure hose
- ☆ Two automotive type wrenches only tools needed apply coupling to hose
- ☆ Reusable — plated to prevent rust
- ☆ No need to strip hose cover
- ☆ Couplings accomodate a range of hose types o than wire braid — reduces coupling inventory
- ☆ Compact design makes neat appearance

## Select the components that fit your needs from the most complete line available

Specify Anchor for hose assemblies that can really take it — that can handle high, medium, or low pressure (or suction) day-in, day-out. Anchor's line of hose, couplings, fittings, and assemblies — the most complete available anywhere — offers you real design flexibility. You get the unit that fits your service requirements exactly. Look over the wide variety of Anchor hose assemblies and fittings — then mail the coupon for more detailed information.



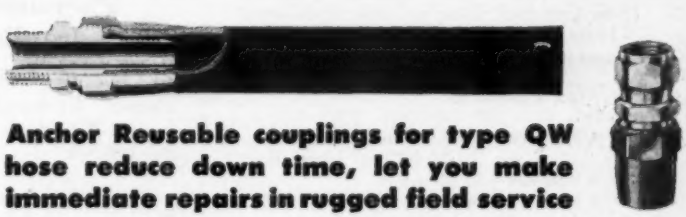

### Anchor adapter unions and pipe fittings are neat, efficient — simplify piping jobs

*Only a few of the many types and sizes are shown*

- ☆ Unions prevent hose strains during assembly
- ☆ Each union eliminates one or more pipe threaded joints
- ☆ Provides easy assembly in confined spaces
- ☆ Unions designed for extra strength. — give you dependable connection
- ☆ Pipe fittings handle pressure up to 3500 psi.

### Anchor one-wire assemblies end leaks, blow-offs in medium and low pressure service

- ☆ Factory assembled to your specifications
- ☆ Positive grip assured by internal thread of coupling shell
- ☆ Couplings are neat and compact
- ☆ Available with swivel male or female nuts
- ☆ Leakproof



### Anchor Reusable couplings for type QW hose reduce down time, let you make immediate repairs in rugged field service

- ☆ Only tools required to attach couplings and hose are vise, oil can, and wrench
- ☆ Repairs made immediately on job — less down time
- ☆ Couplings easily detached and reusable
- ☆ Minimum inventories required in hose lengths
- ☆ Leak- and blow-off proof
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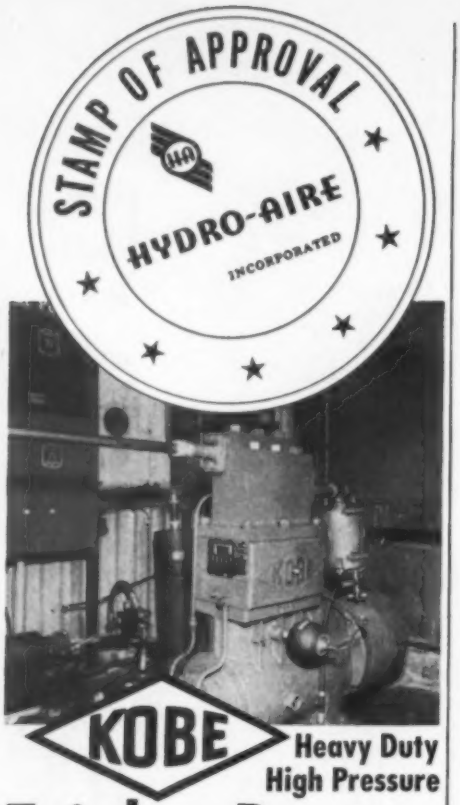


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**Triplex Pumps**

*Case History A7:* Hydro-Aire, Inc., Burbank, California, manufactures aircraft fuel system elements and hydraulic and electrical equipment. In April, 1948, they installed a Size 3 Kobe Triplex to test hydraulic accessories.

*Easy Interchangeability Required*

The service called for intermittent operation at 3000 to 5000 p.s.i. Requirement for such a wide range of pressures was easily met by the Kobe Triplex because of its feature of quick and simple interchange of plungers and liners.

*To Be Used Also in New Texas Plant*

Hydro-Aire's full satisfaction with the Kobe Triplex is best indicated by the fact the Company plans a similar installation in its new Texas plant, scheduled for Fall opening.

*Triplex Features*

- Pressures—To 5,000 psi (standard) To 20,000 psi (special)
- Volumes—To 60 g.p.m.
- Power Ratings—15, 30, and 50 H.P.
- Integral Double Reduction Gears
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- Easily interchanged Plungers and Liners

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# Abstracts of Papers Presented at 9th NCIH

*Chicago, October 8-9, 1953*

*You'll find the complete program on page 66*

## Hydraulics As Applied To Shock Absorbers

*by Robert R. Peterson, Engineering Division, Chrysler Corporation, Detroit*

This paper concerns a type of direct-acting shock absorber developed by the Suspension Department of Chrysler Corporation and used currently on all this company's passenger cars. The Oriflow unit, as it is called, differs considerably from conventional units in construction and even more in performance. Because it is intended to fulfill certain ride requirements ordinarily left to other suspension components, the subject of passenger car ride is considered briefly, with particular reference to the capabilities and limitations of shock absorbers in general. The construction and operation of conventional direct-acting shock absorbers is then described in some detail and their performance characteristics are analyzed and evaluated. Finally the development of the Oriflow unit is outlined and its construction, operation and performance are compared with those of conventional types.

## Friction And Wear Phenomena In Oil Hydraulic Equipment

*by W. P. Green, Manager, Heat Power Research Department, Armour Research Foundation, Chicago, Ill.*

Among the great number of problems faced by the hydraulic engineer and machine designer, the problems of friction and wear belong to the most important and frequently to the most difficult ones. Positive displacement pumps, control valves, actuating cylinders, bearings, and rotating seals of all kinds, show metal parts in rubbing contact with each other, not frequently under considerable loads and speeds. Success or failure of a design can depend on the degree to which friction and wear problems were approached adequately.

Considerable research has been carried out on friction and wear phenomena in the last two decades, which is little known among engineers, but from which useful conclusions can be drawn for design applications. What is the mechanisms

W. P. Green

of dry friction? Is it shearing of surface asperities, seizure, cold welding, or just ploughing action due to roughness? Does transfer of metal take place, for instance between plunger and bore of a piston pump? How thick is a monomolecular layer of a lubricant, and how much lubrication can it accomplish? These and many other fundamental and applied problems have been investigated. Some of the more important old and recent findings are summarized in this paper.

## Ball Piston Pumps And Motors

*by W. T. Rauch and H. Stern, Development Engineers, General Electric Company, Schenectady, New York*

A compact high pressure hydraulic pump, using steel balls as pistons and running at high speed has been developed.

Numerous previous attempts in the United States, and abroad have failed to realize the possibilities of high performance which this simple design offers.

Fixed displacement units of as few as 15 parts, seven of which are ball pistons, have been built for

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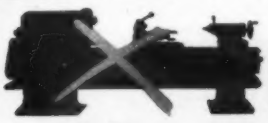

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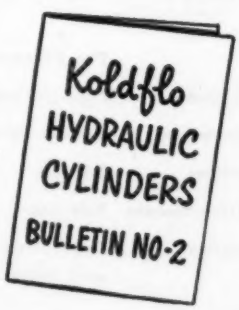
Hydraulic cylinders are made by the Mullins Steel KOLDFLO* Process in *one piece*, coming from the presses with smoothness, hardness, strength and precision never before achieved.

This process eliminates costly 3-piece construction and substantially cuts production costs.




In addition, hydraulic accumulators made by the KOLDFLO Process lose less pressure in performance tests. Less pressure is lost because of the better "O"-ring seal characteristics of the surface of hydraulic accumulators produced by this method.

If you're tired of 3-piece tubing and casting cylinders; if you want a round, straight hole with no taper; if you want BETTER CYLINDERS, write for your copy, Hydraulic Cylinders, Bulletin No. 2, today.

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The Sperry Hydraulic Control, a self-contained system, consists essentially of a hand-actuated transmitter and a receiver connected by a single tube. There is absolutely no dependency on outside sources of power such as electricity or air which are subject to failures. The system is filled with hydraulic oil, and due to the oil's incompressibility, force applied to the transmitter is immediately delivered to the receiver. Any movement of transmitter handle is duplicated by the receiver lever. The Sperry Hydraulic Remote Control System makes possible precision operation of a remote mechanism, free of backlash and the "sponginess" of the ordinary pneumatic control. The operator is assured of instantaneous response, extreme accuracy and "feel" of the operated mechanism even though it is often out of sight and many feet away. Simple and inexpensive installation complete the features appreciated by all in industry.

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## NCIH Abstracts

3000 psi continuous operation. Short peak loads of 5000 psi are permissible.

Units of 5 hp or less have been operated at speeds in excess of 20,000 rpm. Direct drive from ram air turbines, electric motors, or engine pads is possible. A 24 gpm 30 hp pump can be run at 8300 rpm, while larger units up to 500 hp are operated at proportionally lower speeds.

The ball pump features low inertia parts, and consequently has

**W. T. Rauch**

excellent controllability. Pumps, as well as motors of a similar design, are ideally suited as servo components.

Variable and fixed displacement units in combination lend themselves to differential transmission applications. Such a transmission is being used to drive an alternator at a constant speed from a variable speed aircraft engine.

In addition to the common hydraulic fluids, ball pumps have been operated on low lubricity fluids such as silicone and kerosene.

Modern technological progress demands even more horsepower at high operating temperatures. The ball pump shows promise of solving problems of prime importance inherent in high speed, high temperature and lightweight design for aircraft.

---

### Factors In Designing For Mechanical Seal Applications To Hydraulic Equipment

*by Justus B. Stevens, Chief Engineer and H. F. Greiner, Sealol Corporation, Providence, Rhode Island*

The primary purpose of this discussion will be to classify the various types of seal designs, materials and mechanical components and re-



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late this information to the field of hydraulic equipment. Particular emphasis will be placed on the variables which may be encountered in the equipment design which will influence both the selection of the most appropriate seal design and the resultant service results, operating life, convenience for assembly and replacement and related considerations.

All too often the problem of seal selection is left to the last. When this occurs, frequently major designs are fixed, components may be already in process of manufacture, all of which may incumber the seal design with conditions and limitations which would not prevail had the problem been referred to the seal manufacturer at an early stage of design.

Seals will be classified as being of the rotary or stationary type. These will be further classified according to the flexible sealing element, that is, O-ring types, v-ring types, diaphragm and bellows type, etc.

Each design or general arrangement is subject to certain definite limitations such as the temperature limitations placed on synthetic rubbers and certain broad limitations such as surface speeds or mediums where other factors must also be considered. Having established the general area of service limitations, etc. we propose to take several typical hydraulic applications and discuss the various design factors in detail which would affect the selection of the most appropriate and economical seal for the intended service.

A typical problem would be a small hydraulic pump of the positive displacement gear type. Basic elements for consideration would be the medium sealed, temperatures, pressures and surface speed involved. In analyzing the entire problem, however, other factors must also be considered, such as, bearing arrangements and their effect upon the seals, space available for seal assemblies, methods for assembling pumps, seal and mating rings, keeping in mind that replacement may also be a consideration.

Similar problems of common interest will then be discussed. We expect that this will acquaint engineers concerned with hydraulic equipment with the more important aspects of design which should receive attention in order to assure satisfactory application of the mechanical seal.


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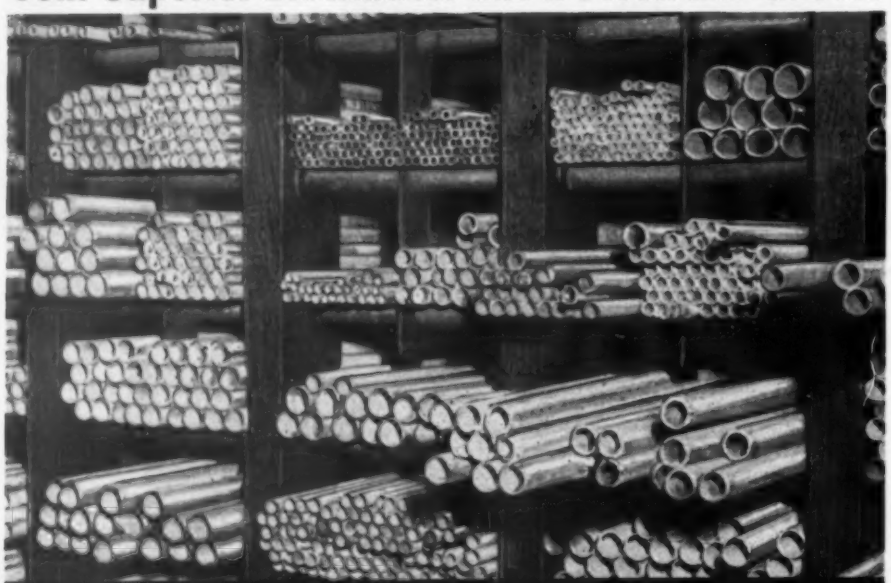

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## Fluid Carriers For Hydraulic Units In Earthmoving Equipment

*by J. E. Jass, Assistant Chief Engineer, Caterpillar Tractor Company, Peoria, Illinois*

The upsurge in popularity of hydraulic actuating units for earth-moving equipment can be traced to the improvement in the various components making up these systems. Better life in pumps, valves, the in-

*J. E. Jass*

100 to 5000 psi
150 in.$^3$/min. at 1000 psi
6 volt—12 volt—28 volt dc—110 volt ac

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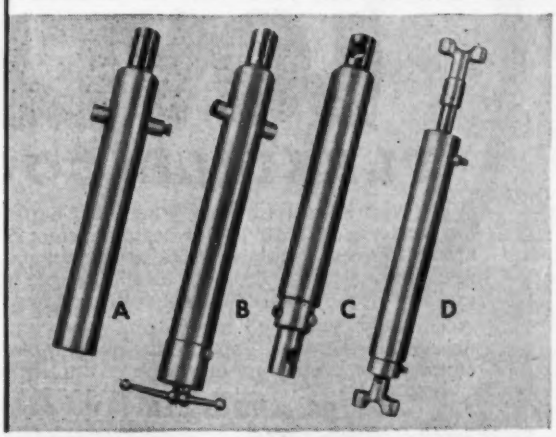
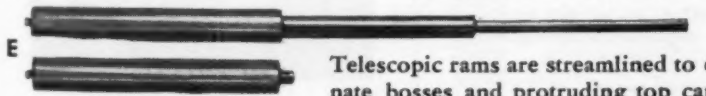
**A.** Trunion mounted ram with oil inlet in one trunion boss.

**B.** Trunion mounted ram with control valves in base.

**C.** Standard single acting ram.

**D.** Push-pull ram with special yokes on base and plunger.




Telescopic rams are streamlined to eliminate bosses and protruding top caps.

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troduction of effective filters, and the more effective sealing up of the fluid carriers has combined to bring about hydraulic units that are considered both reliable and versatile. A great amount of development work has been done on each of these elements to bring them to their present customer acceptance. The fluid carrier has been no exception in this story of development and progress.

At least three types of fluid carriers are still in common use on earthmoving units. The regular black iron with tapered pipe threads and fittings are still found in many applications. The seamless, or welded steel tubes shaped to the proper configuration with welded flanges provided with "O" ring joints have increased in popularity since World War II. The tube carriers with assembled elbows and fittings of the compression type, or with some other design of "on the job" assembled fittings are still also popular. Each of these types usually used in combination with high pressure hydraulic hose, make up the means used to get the hydraulic fluids from the pump to the valves and to the hydraulic actuating cylinders. Examination of typical earthmoving machines indicated reasons for choice of each type, but provides the necessity of keeping the fluid inside the carrier so that absolute leak prevention and dirt exclusion is met.

Late developments of flanged, shaped fittings used in combination with bent tubes and welded or brazed ends are discussed from the angle of application as well as cast.

The future needs for more easily designing hydraulic units and especially fluid carriers into earthmoving machines are reviewed—Good, reliable, quick disconnect couplings and leak proof rotating joints are two elements that are still necessary to further the program of completely satisfactory and inexpensive hydraulic unit application to earthmoving equipment.

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## Hydraulic Problems Of Large Forging Presses

*by E. V. Crane, Chief, Special Development Engineering and W. R. Jackson, E. W. Bliss Company, Canton, Ohio*

The portion of the Air Force tooling program which aims to increase press capacity for the production of large forgings for aircraft, has raised many problems by reason of the great size of the units. Distribution of press building contracts

among a number of large concerns to get the work done, has introduced different points of view with interesting differences in the solutions worked out.

While structural and shipping problems have been extraordinary,

these have been quite thoroughly discussed and our concern here is with hydraulic problems.

Underdrive vs Overdrive. Whether the hydraulic cylinders should be above or below the die space raised questions of line lengths, subsoil stability, crane height and foundation depth economics. The solutions are about equally divided on this problem. Unusual loading and balancing requirements were introduced.

Water or treated water vs. Oil or other hydraulic media raised some interesting discussion. Lubricity, corrosion, wire drawing, fire hazard and maintenance costs contribute to decision with indeterminates still present.

Accumulator central system vs. self-contained systems of various sorts opened much room for differences in thinking. It is necessary to put very large presses together with smaller presses in ways which will give maximum flexibility for a variety of work and protection against shut down in case of individual failures. Efficiency and cost of operation raise questions not yet too well defined.

Some critical questions have been raised as to why all of the differences could not have been solved in advance and incorporated in a common design. Some heart-breaking delays have been experienced due to differences in thinking but in general, excellent progress has been made and all units in progress should prove effective.

---

## Development Of Hydraulic Drives For Continuous Process Industries

*by Ransom Tyler, The Oilgear Company, Milwaukee*

In view of the fact that the needs of the process industries and the characteristics of positive displacement fluid drives are so nearly parallel, it is strange that greater use has not been made of the fluid drive by these industries. Successful installations have been made and have operated over periods ranging up to 30 years, but these have been exceptions rather than the rule.

The problem involves driving a single machine which is made up of several sections or individual unit machines, all handling a single continuous web, filament, or a flow of material. The speed of each individual unit must bear a fixed relationship to the other machines of

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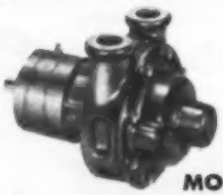
**MODEL CKB**

Same as Model CK, sizes 2 to 6, with dependable Tuthill mechanical shaft seal.



**MODEL RCK**

Includes Tuthill's exclusive automatic reversing feature which permits driving pump in either direction without changing direction of flow or port positions. Available also with mechanical seal as Model RCKB.

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the whole. This relationship must be adjustable to compensate for changes in the material or process but must be held fixed while the entire machine varies in speed.

The various means provided in the past, while generally satisfactory contained minor defects. Recently

***Ransom Tyler***

an all-hydraulic drive using feed-back principles has been applied. While the application of feed-back principles are now new, it is believed that the all-hydraulic method is inherently more stable than those in common use.

A general analysis of this system using servomechanism theory has not been attempted. However, both pilot plant and field experience has been very satisfying. The units used are standard except for minor modifications, and are rugged and dependable. The system is flexible in its characteristics and application. It will be surprising if all-hydraulic feed-back type fluid drives are not to be found in greater numbers on processing machines in the future.

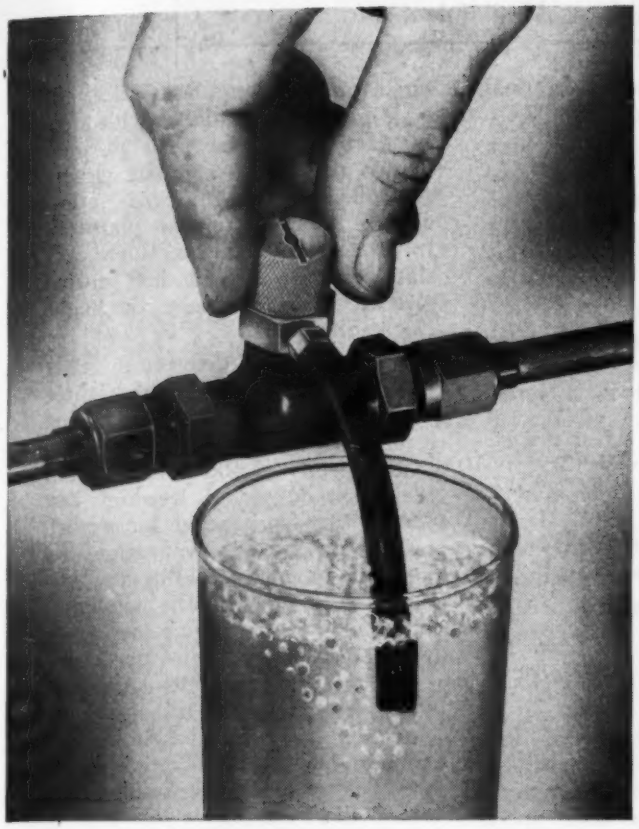
---

## A Flowmeter For Measuring Mass Flow-Rate With A High Speed Of Response

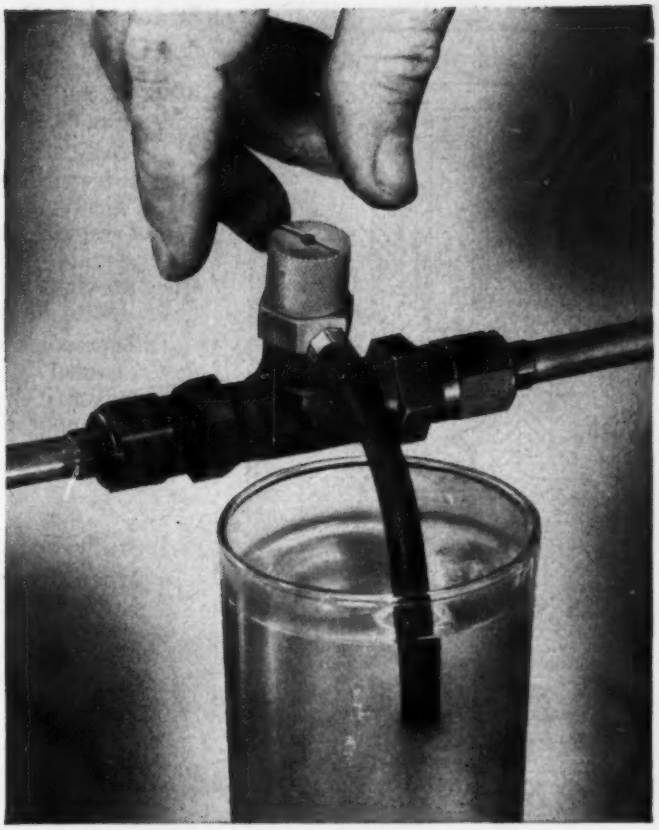
*by Dr. Yao Tzu Li, Massachusetts Institute of Technology, Department of Aeronautical Engineering, Cambridge, Massachusetts*

A flowmeter is described whose output varies linearly with the mass flow-rate of fluid passing through it. The instrument measures the torque required to apply a Coriolis acceleration to the fluid stream. This torque depends only on the mass rate and is independent of other physical properties of the fluid, such as pressure, density and viscosity.

The output of this mass flowmeter is independent of temperature variations and the meter may be used



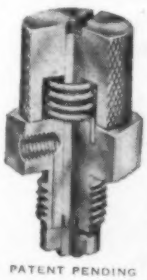
**TWIST IT'S OPEN!** A twist of your fingers opens the new Greer-Lane semi-automatic bleeder valve. What a contrast with old fashioned "monkey wrench" methods! Valve is easily installed with a T-connection.



**RELEASE IT'S CLOSED!** The free end of bleeder valve hose immersed in fluid tells operator air is out of system when tell-tale bubbles end and first signs of oil appears. No more guesswork. Details below.

# New Precision Valve Makes Bleeding Fast Fingertip Operation

## *Ingenious Greer-Lane semi-automatic valve ends bleeding problems forever*



PATENT PENDING

Usual methods of getting air out of a system leave much to be desired. They are slow, often awkward, and in many cases require a mechanic to guess when air is out, or risk spouting fluid all over the floor. Man-hours wasted and production downtime add up to appreciable losses.

The Greer-Lane semi-automatic bleeder valve is the perfect solution to this problem. It permits bleeding with a quick twist of your fingers. You twist to open, release to close. It is fast, clean, safe, and *self-cleaning*. No sediment can clog its tiny port openings or mar its operation. Precision-made, it will give years of dependable, trouble-free service.

Nothing could be simpler! Bleeding time is cut to minutes; costly hydraulic fluid is conserved. "Oil gushers" spouting from present methods are gone forever. The free end of a bleeder valve hose connected to the port opening may be immersed in a beaker of fluid and carefully watched for the end of tell-tale bubbles and the first signs of oil.

Don't let poor bleeding methods bleed your pocketbook. Loss of valuable man-hours and production *can* be avoided. Install the new Greer-Lane semi-automatic bleeder valves on your hydraulic or pneumatic equipment. Low in cost, they will pay for themselves quickly. Solve bleeding problems by writing or calling Greer for details and prices of the new Greer-Lane semi-automatic bleeder valve. Do it today!

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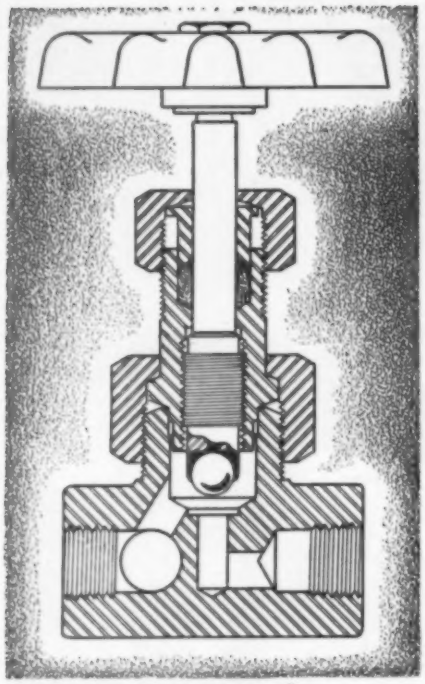

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bi-directionally due to its electrical and mechanical symmetry.

The construction allows for a high natural frequency so that it is capable of measuring instantaneous values of rapidly varying flows. The meter is also ideal for measuring true average values of pulsating flows due to its linearity.

The versatile performance of the meter, gained by these ideal properties, makes it useful in a broad range of applications.

---

## Aircraft Variable Delivery High Pressure Fuel Plunger Pump

*by John Pelz, Bendix Products Division, Bendix Aviation Corporation, South Bend*

The J. P. series high pressure fuel pump is multi-plunger, variable stroke, positive displacement type, incorporating built-in over speed and maximum pressure control mechanisms. Delivery and pressure can be accurately and automatically selected by a remote control device.

Below is a brief outline of sections of the paper to be presented.

1) History of pump prior to its manufacture in this country.
2) Description of schematics of:
   a) Fuel delivery section
   b) Pump Control section
   c) Over speed control section
3) Pump characteristics and curves.
4) Brief description of pump analysis and advantages of this design—development of water proofing rotor.
5) Uses:
   Motor
   Positive Displacement Pump
   Used as flow meter satisfactory to .25% accuracy
   Variable stroke

---

## Evaluation Of An Hydraulic Control For A Flight Simulator

*by D. Skoog, Control Systems Section, Armour Research Foundation, Chicago*

This paper describes a portion of the work performed in connection with a program for the development of a laboratory instrument which provides angular motions of a platform in accordance with electrical voltage signals. The purpose of this device is to impart closely controlled angular motions to test objects mounted on the platform. In particular, these motions may simulate the roll, pitch, and yaw of aircraft in flight, hence the name Flight Simulator.

Following the theoretical study and preliminary design of a three degree of freedom simulator having a platform of 4 feet diameter and a load capacity of 100 pounds, a full scale one degree of freedom Test Model was constructed for experimental purposes. Specifications relating to attitude stability and dynamic response of the simulator imposed severe requirements on servo components—in particular, the hydraulic controller. A nozzle drive, closed-center, transfer valve designed for maximum flow of 35 gpm at 5000 psi was employed in the Test Model. Test results indicated that the major obstacle to achievement of a workable system was the performance of the valve.

A discussion of an investigation of this valve constitutes the major concern of this paper. In an attempt to provide the necessary context for this discussion a brief description of the Test Model is included.

---

## Economics Of Standardized Maintenance And Testing In Airplane Fluid Systems

*by Julius Kendall, Vice President, Greer Hydraulics, Inc., Brooklyn, N. Y.*

The paper will cover essentially hydraulic systems and other components as well as fuel systems. The

*Julius Kendall*

emphasis will be on the hydraulic controls and valves and jet turbine

**UCON** hydrolubes
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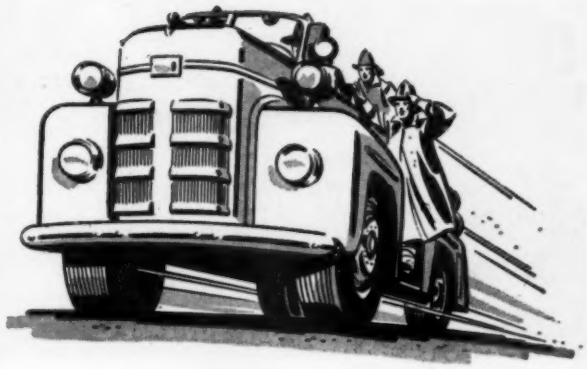

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To change over to UCON hydrolubes, drain the old fluid from the system, follow our recommended cleaning procedure, and refill. UCON hydrolubes have no adverse effects on most packings and seals. No need to revamp your present equipment, other than replacing packings and seals that are in poor condition. Leakage losses are often lower than with regular hydraulic fluids. UCON hydrolubes contain corrosion inhibitors for the common metals. They come in several viscosity grades to fit your specific requirements.

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- Good lubricity
- High viscosity indexes (150 to 160)
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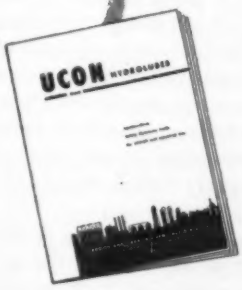


A comprehensive booklet, "UCON Hydrolubes" (F-7380), gives detailed information on properties; advantages; and procedures for installation, filtering, and maintenance. Write for your copy today. And if you have specific questions, we will be glad to answer them.

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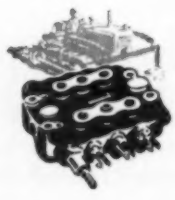

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engines as they pertain to the fuel systems. The paper will cover essentially the hydraulic development of aviation during the past 15 years as it affects methods and procedures of testing and maintenance. This will be broken down as follows:

1. Problems of the airline operator in attempting to get the best utilization of his aircraft due to the variability of locality in which he is operating, requiring that maintenance and overhaul be carried out in various locations and requiring that standardization of procedures and equipment be such that the same results can be obtained regardless of where work is done.
2. Problems of keeping abreast with technological changes to be sure that new equipment and procedures are available as new accessories develop so that commercial overhaul facilities will be available when equipment requires overhaul.
3. Design of test equipment that average mechanics can readily utilize and from which they can interpret the results for the problems that might be encountered in everything from reciprocating to turbojet or turbo-prop engines.
4. The fundamental principles of overhaul and test which develop from component manufacturer to airframe manufacturer, to military operator, to commercial airlines. The need for standardized procedures and methods both in military and commercial aircraft and maintenance.

---

## Hydraulic System Of The Golden Jubilee Ford Tractor

*by Harold L. Brock, Tractor Engineering Department, Ford Motor Company, Dearborn, Michigan*

Paramount among the problems of designing a farm tractor is the difficult task of planning and reacting a suitable hydraulic system of controlling implements. Such a system must be adequate in construction and operation, simple to service, and economical to produce in order to properly fulfill design objectives.

The purpose of this paper is one of presenting to the reader the approach Ford engineers took in designing, developing, and testing the system used in the new Golden Jubilee Ford tractor and in turn pointing

out the many design considerations that must be recognized in order to produce a satisfactory unit.

The paper will embody a resume of the experiences gained through

*Harold L. Brock*

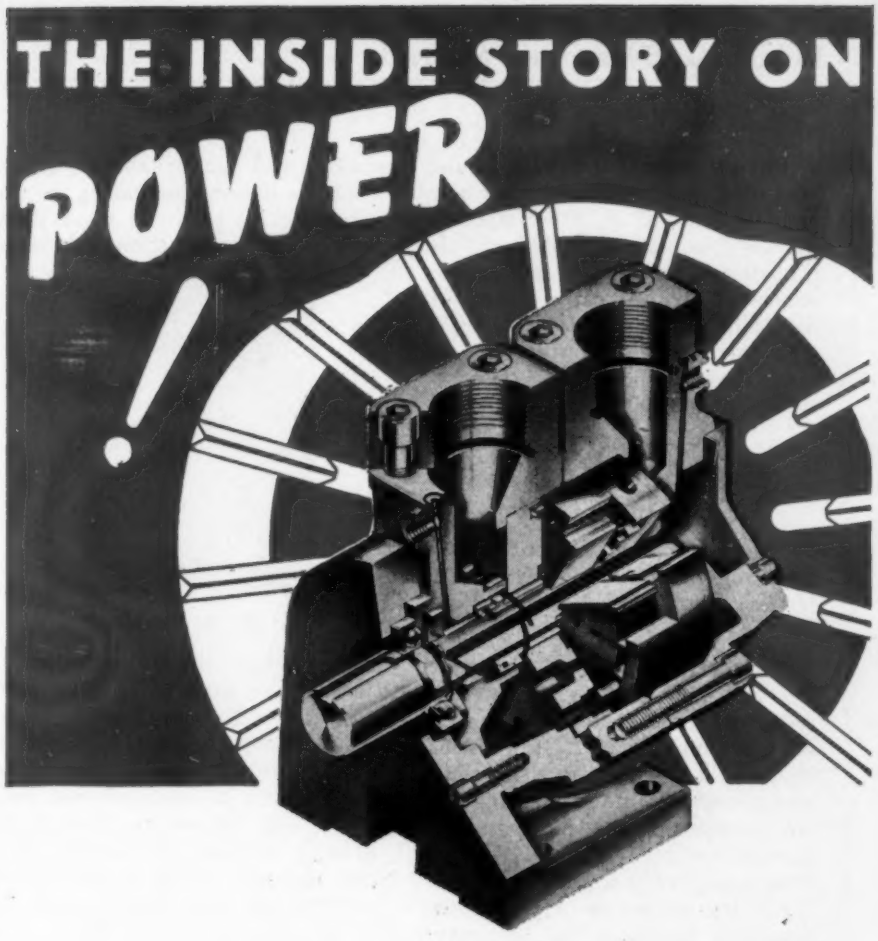
the production of 825,000 tractors equipped with previous designs of hydraulic controls. It will be brought out that these experiences coupled with the technological advancements in the Ford Motor Company formulating a program to extend the usefulness of the tractor by increasing its size and power and providing a more flexible hydraulic system. Upon completion of this background information a comprehensive explanation will be given of the circuit and linkage by the use of slides. The following and concluding part of the paper will encompass the problems of tailoring the circuit to provide a unit that is most compatible with the tractor and equipment.

---

## Industrial Application Of Non-Flammable Hydraulic Fluids

*by D. Milne, Supervisor Materials and Processes, General Motors Corporation, Detroit*

This paper covers the properties expected of a non-flammable hydraulic fluid intended for industrial application. The information presented represents the thinking and experience of men concerned with the operation of such equipment as die casting machines, furnace actuating mechanisms, welding equipment, baling machines and other pieces of equipment presenting direct or indirect hazard from fire. Those properties needed in hydraulic fluids besides their non-flammable characteristic are also described and some indication given as to difficulties experienced with fluids now on the market. A resume of past applications of non-flammable fluids in industry, particularly with reference to those operations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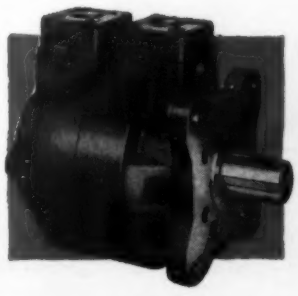

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of the automotive industry, is also presented, and the necessity for non-flammable fluids in other applications is discussed. The effect of fluid properties on operation and maintenance of hydraulically actuated equipment is emphasized, together with the necessity for careful appraisal of non-flammable fluids to avoid operational difficulties.

## Hydraulic Actuation Of The TD-24

*by W. W. Henning, Divisional Chief Engineer, International Harvester, Melrose Park Works, Melrose Park, Illinois*

A growing demand for large tractors with increased agility and with reduced operator effort fostered the introduction of the TD-24. This machine is a 20 ton crawler tractor incorporating a novel steering system actuated by power hydraulics, thereby reducing operator effort to that of finger-tip control. The steering system known as "Planet Power Steering" increases the maneuverability and controllability of the machine, thereby increasing the useful output. It provides a two speed shift-under-power speed changing

W. W. Henning

device behind the transmission, reducing the number of gear shifts required of the operator.

Hydraulic actuation of the planet power steering system was chosen for reasons of compactness, reliability, and durability. Due to the difficult environment under which this machine works, a particularly rugged and long lived system had to be developed. The system now tried and proven is of the unloading valve acculator type does its job efficiently and dependably. It provides the high level of hydraulic horsepower required for the quick response of the system without absorbing appreciable power from the engine at any time.

This is one of the applications of hydraulics as applied to the control of earthmoving equipment which indicates a constantly broadening use of this extremely useful tool for providing mechanical muscles for man.

## The Effect Of Synthetic Fluids On Hydraulic Components And Circuits

*by James Robinson, Chief Engineer, Vickers Inc., Detroit*

The art of applying what has been termed industrial hydraulics actually embraces three distinct and entirely different fields. They are the aircraft, the mobile, and the machine tool fields. Naturally there are many diversifications in each of these fields. Some of which may overlap. The effect of the hydraulic medium used differs widely depending upon the application. Recent analyses indicate that while certain characteristics are of prime importance in all fields, the secondary or detailed characteristics of the fluid vary widely both in type of desired results and also the importance of these results.

During one analysis the industrial application field was divided into two sections, one of which was classified as standard machine tools and the second one as hazardous industrial equipment. This latter category embraced in particular diecasting machines, hydraulically operated welding machines, hot forging presses and furnaces. Obviously fire was uppermost in the engineer's mind when these particular machines were selected as hazardous, and for this reason non-flammability (to a reasonable degree) was a prerequisite of the hydraulic medium to be used. Even in this machine category, however, this characteristic was rated second to a single item that was outstanding in every field of hydraulics; i.e., the medium used must have good lubricating qualities with the presently available materials for bearings and other rubbing surfaces.

It has been said that engineering is a good deal like golf: Those with a pleasing approach will find salvation in salesmanship and for those

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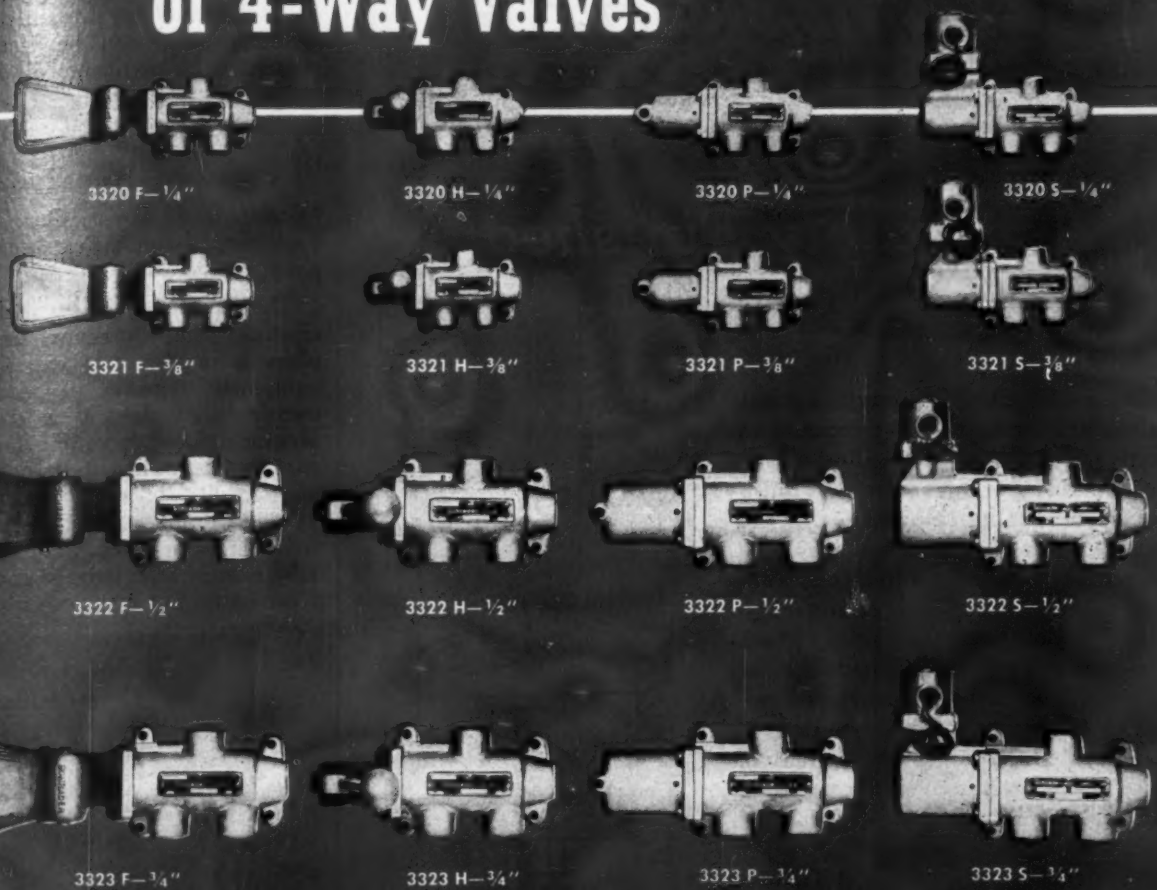


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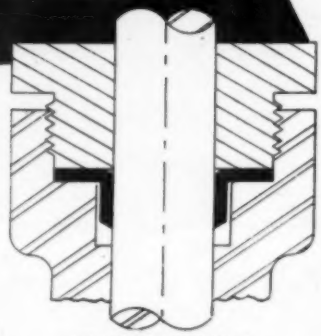

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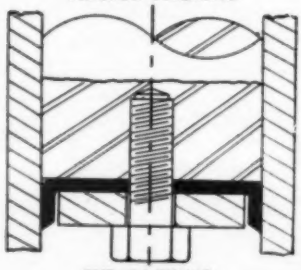

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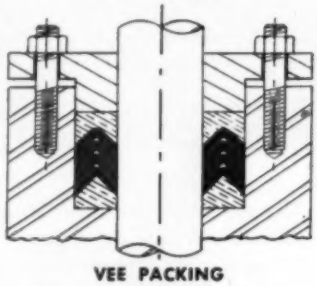

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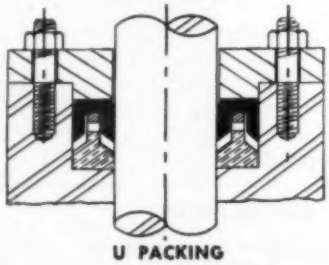

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whose best shot is with the brassie, the advertising profession offers an opportunity in case of a good life. While the substitution of nylon hose for those of pure silk may be simply a matter of exchange of parts, I do not believe that any presently known synthetic fluid can be freely exchanged with petroleum oil without careful analysis.

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### Pressure Transducers

*by Robert E. Boyar, Development Engineer, Askania Regulator Company, Chicago*

The advent of fundamental investigations into pressure transient phenomena demands experimental equipment capable of measuring transients of short time duration. Measuring and recording the pressure transient phenomena points the way toward product improvement by indicating the magnitudes and frequencies involved. Obtaining this information is relatively simple in some cases, but may present a difficult problem in others. The prime requisite for measuring pressure transient phenomena is measuring and recording equipment that will faithfully reproduce the transient under investigation to the desired degree of accuracy.

*Robert E. Bayer*

The problem resolves itself into roughly estimating the magnitude of the pressures involved and the highest frequency of the transient. The rough estimates, multiplied by an ignorance or safety factor, determine the basic requirements of the measuring equipment for accurate representation of the pressure transient. Once these requirements are determined, the engineer confronts the problem of obtaining the equipment most practical from both a cost and an engineering viewpoint.

The basic component of such equipment is the pressure transducer. Among the types commercially available are the piezoelectric, the balanced diaphragm, the flat diaphragm, and the catenary diaphragm-strain generating tube.

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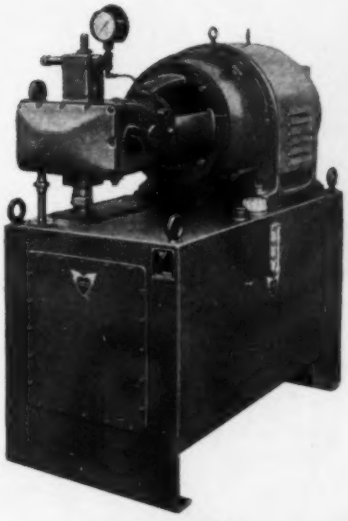

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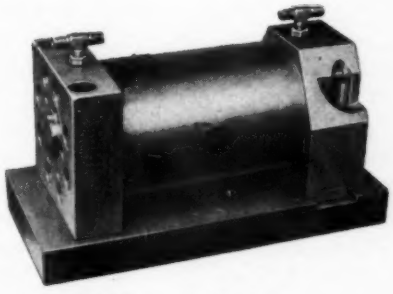

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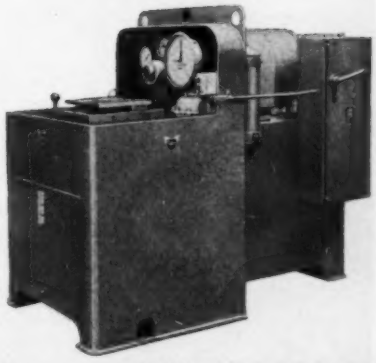

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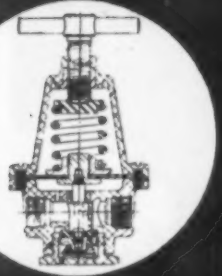

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# *Where Can You Enter a Training Course in Hydraulics and Pneumatics?*

TO compile the following list of training programs, APPLIED HYDRAULICS surveyed courses offered by industry, cooperative and extension schools, colleges and technical schools. While the general situation is that specific oil hydraulic and pneumatic programs are, as yet, relatively few it is apparent that progress has been made in a number of places. This list of training courses will be useful, not only for the factual information, but, in addition, as suggestions for those who are in the process of building such training courses.

The in-industry group is selected for types of training programs. Since it would be impractical to list every manufacturing plant or organization where such programs exist, a relatively small number, selected for the type of training program now in successful operation, has been selected.

In the second section of the check list—co-operative and extension schools—there are three representative types of training programs: (1) those offered by established universities and technical schools on the well-known "work-learn" co-operative basis; (2) training offered in evening or branch schools in industrial areas; and (3) special, directly practical courses offered by vocational or trade schools.

The third section of the check list gives the data furnished by colleges and engineering schools. All institutions which are members of the American Society for Engineering Education were invited to send data on specific or closely related curricula on oil hydraulics or pneumatics. A sufficient number of replies have been listed to indicate that relatively few of our leading engineering schools have, as yet, set up specific courses in these fields. Of course, all mechanical engineering curricula include courses in Fluid Mechanics. A number recognize the growing importance of oil hydraulics and pneumatics and in several cases efforts are being made to meet the increasing demand for both basic and specialized training in these fields.

In this first effort to survey the field for typical training programs, we are certain that a number of effective programs for hydraulics and pneumatics have not come to our attention. We will appreciate it if details of such programs be sent to the editor. The list of courses will be enlarged and kept up to date. Further details on any courses in the list will be available on request.

***Here's a description of training courses being offered throughout the country. If you're planning a course, you'll want to study each program.***

## I. In-Industry Programs

**General Motors Institute,** Flint Mich. Mechanical Hydraulics, an intensive, two-weeks course at Flint is open to technicians employed in any of the General Motors plants. It is designed to acquaint the individual with the different types of hydraulic pumps, valves and motors used on modern machine tools; teach him to read hydraulic circuit diagrams; and enable him to study the causes of trouble and methods of checking and remedying them. Instruction includes types of pumps, their construction and operation; types of valves, their uses, construc-

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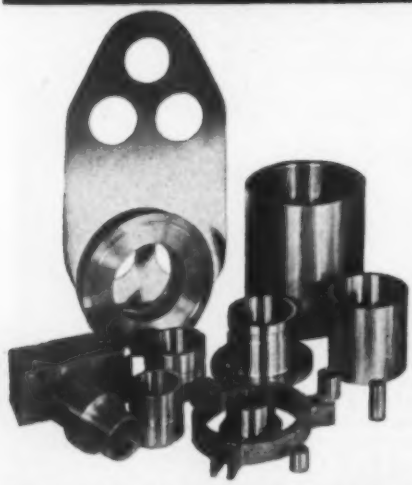

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## Training Courses

tion and adjustments; circuits, tracing, checking and repairing. Typical circuits are built up using standard components found in use in most industrial applications.

**Vickers, Inc.**, Detroit, Mich. A practical intensive course in the Fundamentals of Operation and Maintenance of Hydraulic Equipment. The morning sessions of this two weeks course is devoted to lectures, the afternoons to practical laboratory work. Lectures are presented with the aid of films, slides, cutaway models, literature and a blackboard. Elementary hydraulics, two-stage pumps, piston pumps and motors, directional and flow control valves, feed controls, prefill valves and press circuits are covered. In the laboratory each student dismantles, cleans, repairs, assembles and tests components. Admission is by invitation.

**The Oilgear Company**, Milwaukee, Wis. A short practical training course for service and maintenance men employed by users of this company's equipment. The course is in preparation and the first class is expected to be held soon. The course is expected to run 1 to 2 weeks. It's possible that a second class for hydraulic engineers will be added later if the demand justifies it.

**Diamond Chain Company, Inc.**, Indianapolis, Ind. The Personnel Department of this company will offer this fall a basic course in the Fundamentals of Hydraulics and Pneumatics for their machinist apprentices and other shop employees.

**The Parker Appliance Co.**, Cleveland, O. Training course for fittings distributors. Designed for the personnel of distributors, the one week's sessions are divided between lectures and practical bench work on tube fittings and their circuits. The objective of the course is to enable Parker distributors to analyze customer's tubing


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problems and recommend the correct tubes and fittings by making original mockups of efficient tube circuits and testing them for actual performance. A similar course is held for the personnel of distributors of rubber products.

**The Weatherhead Co.,** Cleveland, O. A short training course on the Assembly of Hose and Tube Fittings. For selected customer personnel and for aircraft and industrial departmental personnel in the company, including field engineers. Personal instruction and practical work by students on low, medium and high pressure hose and hose ends, flare and flareless fittings.

## II. Co-Operative and Extension Schools

**The Bridgeport Engineering Institute,** Bridgeport, Conn. Evening School of Engineering: Fluid Mechanics.

**University of California.** Berkeley and Los Angeles, Calif. and at many of the major cities in the state, Colleges of Engineering: Elementary Fluid Mechanics; Applied Fluid Mechanics; Instrumentation and Automatic Control; Analysis of Servomechanisms; Advanced Theory of Servomechanisms and several group studies of related interest.

**General Motors Institute,** Flint, Mich. Cooperative Engineering Program: Fluid Mechanics; Hydraulics of Industrial Equipment (operating principles and construction of hydraulic pumps, valves, accumulators, intensifiers, fittings and tubing, oils and oil seals and cylinder assemblies); Hydraulics Applied to Industrial Equipment (study of the construction and operation of the more advanced hydraulic circuits. Particular attention is given to the design characteristics of circuits). See also In-Industry Training Programs.

**Michigan State College,** East Lansing, Mich. Department of Mechanical Engineering Evening School: Industrial Hydraulics (twenty two-hour lecture periods, attended by engineering

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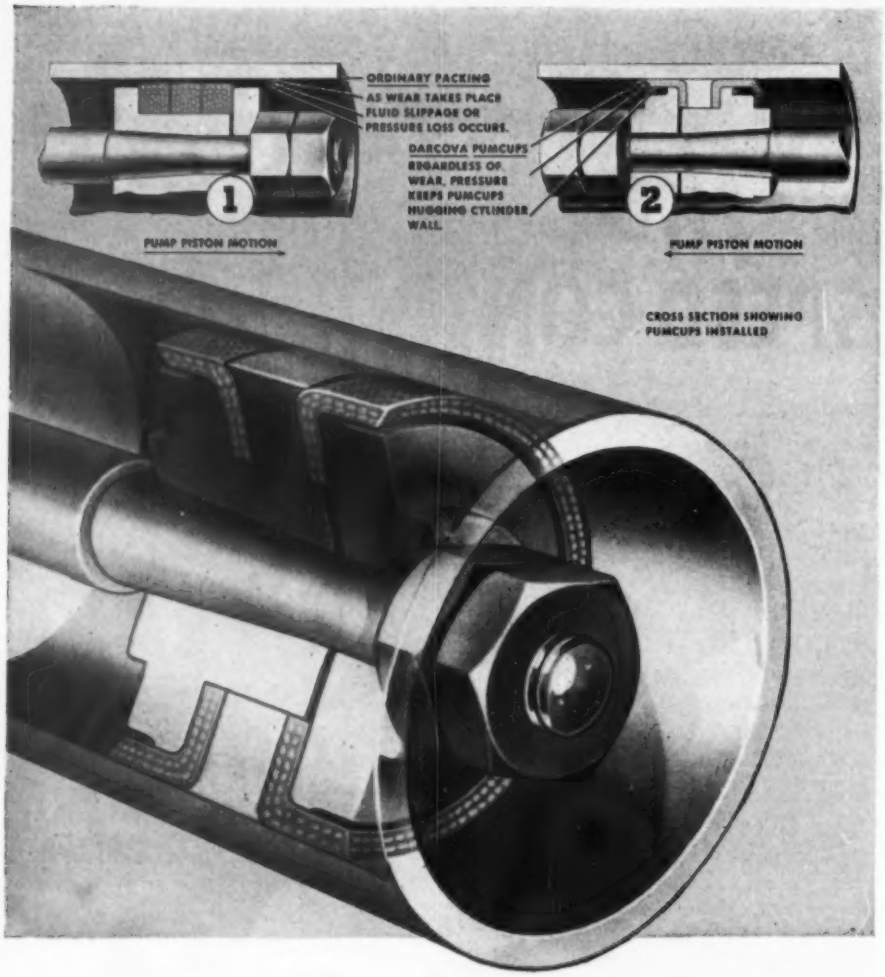
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*IN air and hydraulic cylinders and reciprocating pumps* Darcova Pumcups actually retain full efficiency *throughout* their life span . . . and they outlast most other packings at least 3 to 1!

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THE ORIGINAL COMPOSITION CUP
PUMCUPS

## Training Courses

personnel in nearby plants. Instruction supplemented by talks by specialists in specific fields).

**Northwestern University,** Evanston, Ill. Each student is required to spend six quarters in industry before graduation, all engineering courses covering a five year period, eighteen months of which are spent in industry under the supervision of the Institute. See Colleges and Engineering Schools list.

**Ohio Mechanics Institute,** Cincinnati, Ohio. Evening Technical Division: Hydraulic Mechanisms (lectures and discussions based on hydraulic circuits as applied to machine tools. Designed to prepare machine tool repairmen to analyze and understand hydraulic operation of any machine tool with only the machine and the schematic diagram of its hydraulic circuit at his disposal. This course was set up last year in response to a request of several leading manufacturers and users of machine tools in the Cincinnati area.)

**The Pennsylvania State College,** State College, Pa. Mineral Industries Extension Service: The Application of Hydraulics to Mining Equipment. (Study of hydraulic fundamentals leading into the hydraulic control of mining machines. The course of 150 hours is half devoted to shop work on examination of and work with equipment, half to the classroom. Sessions meet evenings for two or three hours, twice weekly. Designed to provide training for three types of mechanized mining employees—supervisors or foremen, operators and maintenance men. Classes on either a "private" basis—joint control of the sponsoring company and the College—or "vocational basis"—under control of local school board with the College acting in a supervisory capacity. This program was held last year at Johnston, Pa.; this year it will be held at Johnston, Uniontown and Pittsburgh).

Organizational procedure and an outline of The Application of Hydraulics to Mining Equipment is available from Myles E. Altimus, Jr., Assistant Professor in Mining Extension, Pennsylvania State College.

## III. Colleges and Engineering Schools

**University of California,** Berkeley and Los Angeles, Calif. Mechanical Engineering Department: Elementary Fluid Mechanics; Applied Fluid Mechanics; Elementary Hydrodynamics; Instrumentation and Automatic Control (undergraduate); Theory of Pumping Machinery; and Mechanics of Real Fluids (graduate). The following courses in servomechanisms are also offered. The Fundamentals of Servomechanisms (undergraduate and Engineering Extension program); Advanced Theory of Servomechanisms (graduate). See also Extension school listing.

**Carnegie Institute of Technology,** Pittsburgh, Pa. Department of Mechanical Engineering: Fluid Mechanics (undergraduate); Advanced Fluid Mechanics (graduate).

**Case Institute of Technology,** Cleveland, O. Department of Mechanical Engineering: Fluid Mechanics (undergraduate): Instrumentation and Automatic Control (graduate study, day and evening); Design of Instrumentation Equipment; Servomechanisms (including pneumatic and hydraulic controls.)

**Colorado Agricultural and Mechanical College,** School of Engineering, Fort Collins, Colo. Graduate School: Applied Mechanics of Fluids; Advanced Mechanics of Fluids (practically entirely devoted to water).

**Dartmouth College,** Hanover, N. H., The Thayer School of Engineering: All engineering students; Fluid Mechanics.

**University of Detroit,** Detroit, Mich. Mechanical Engineering; Fluid Mechanics; Aeronautical Engineering; Elementary Theory of Viscous Fluids; Engineer-

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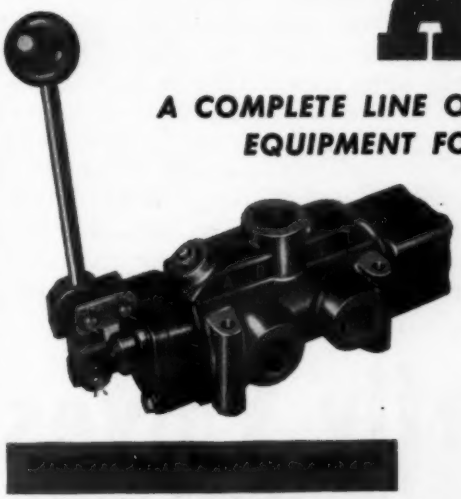

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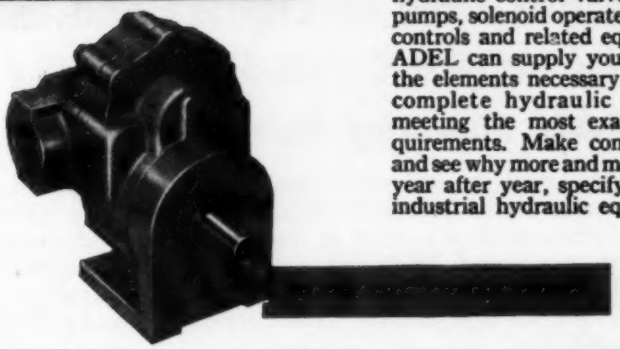

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Manufacturers of Industrial Hydraulic Valves and Pumps

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ing Mechanics; Elementary Fluid Mechanics. This university also operates on the cooperative plan past the first two years and operates an Evening Division in which all the regular freshman and sophomore courses in engineering are offered.

**Harvard University,** Cambridge, Mass. Division of Applied Science: Fluid Mechanics; Mechanical and Civil Engineering: Hydro- and Aerodynamics; Advanced Hydro- and Aerodynamics; Hydraulics.

**Lehigh University,** Bethlehem, Pa. The Institute of Research: Oil hydraulics and pneumatics are covered to some extent in various engineering courses in fluid flow and related courses. Some experimental work is in progress in their laboratories in problems of oil flow, viscosities, cavitation, etc.

**Massachusetts Institute of Technology,** Cambridge, Mass. Department of Mechanical Engineering: Fluid Mechanics; Design of Industrial Oil Hydraulic Machinery (undergraduate); Advanced course in the flow of fluids, thermodynamics and dynamics (graduate). In addition an extensive program of research offers outstanding opportunities for graduate students to work in the laboratory.

**Lafayette College,** Easton, Pa. Department of Mechanical Engineering: Fluid Mechanics; Mechanics Department: Hydrodynamics.

**Illinois Institute of Technology,** Chicago, Ill. Department of Mechanics: Oil Hydraulics. This three semester hour, non-credit course will be offered for the first time in 1953-54. O. E. Teichmann, Assistant Chairman, Heat Power Research Department, Armour Research Foundation and 1953 Director of the National Conference on Industrial Hydraulics, will be the instructor. A short course in oil hydraulics on the maintenance level is planned for the summer of 1954 and an elective course in oil hydraulics for the fall of 1954.

**University of Illinois,** Urbana, Ill., College of Engineering, Department of Theoretical and Applied Mechanics: Fluid Mechanics; Fluid Mechanics Laboratory (undergraduate); Fluid Mechanics and Advanced Hydraulics (advanced undergraduates and graduates).

**University of Minnesota,** Minneapolis, Minn. Institute of Technology, Hydromechanics: four courses in Fluid Mechanics; Hydraulic Pumps and Motors (including hydraulic transmissions and torque converters).

**University of Missouri,** Columbia, Mo., College of Engineering, Mechanical Engineering Division: Hydraulics Machinery (undergraduate); Flow of Compressible Fluids (graduate).

**Northwestern University,** Evanston, Ill. The Technological Institute: Fluid Mechanics (for the past several years each stu-


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A 7555-½H




Circle 73 on Reader Service Card

Circle 163 on Reader Service Card

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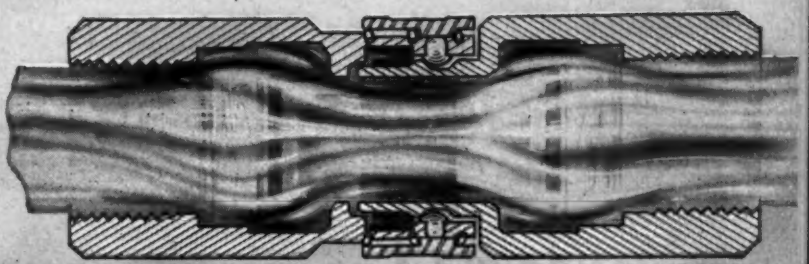

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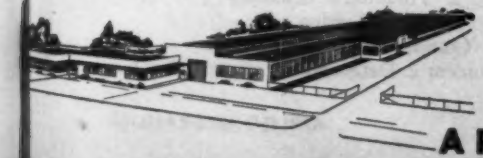

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## Training Courses

dent has prepared a short talk on some type of hydraulic control, using material from copies of APPLIED HYDRAULICS); Advanced Hydraulics (this course is slanted in the direction of hydraulic controls, the degree depending on the wishes of the class).

**Fenn College,** Cleveland, O. The Technical Institute at Fenn College offers two courses in Industrial Hydraulics. Each course meets for 16 two hour sessions once a week, in both the Fall and Spring semesters. Courses are attended by engineers, production and maintenance men from industries in the Cleveland area. Industrial Hydraulics I emphasizes fundamentals, course II deals further with development of circuits. Problems and slides are used.

Industrial Hydraulics I uses the following outline:

I. Introduction
- A. Scope of course—Why oil hydraulics?
- B. Applications
- C. Simple circuits to illustrate the major components of hydraulics systems—pumps, valves, motors and cylinders.

II. Simple Mechanics and statics
- A. Pressure and force
- B. Flow
- C. Piston velocity
- D. Power

(Problem 1 Determining pressures, force, work)

III. Discussion of pumps
- A. Construction of various types
  1. Fixed displacement
     - a. Gear: spur, helical, internal
     - b. Vane
     - c. Piston: axial, radial, reciprocating
  2. Variable displacement
     - a. Establish need
     - b. Piston
     - c. Vane
     - d. Combination Pumps, Package Units
  3. Centrifugal

IV. Pumps (Continued)
- A. Characteristics
  1. Leakage
  2. Volumetric efficiency
  3. Input Torque
- B. Comparison between types

(Problem 2 Determining oil velocities)


Circle 61 on Reader Service Card

V Motors

A. Types
   1. Rotary: gear, vane, piston, turbine
   2. Linear
      a. General construction
      b. Packings
   (Problem 3 Determining piston velocity)
B. Applications—Linear and rotary motions

VI. Transmissions

A. Three combinations of hydrostatic transmissions
B. The hydrokinetic transmission

VII. Valves

A. Types
   1. Directional
   2. Pressure
   3. Volume
B. Methods of operation
(Problem 4 Design of a gear pump)

VIII. Valves (Continued)

A. Review of standard type comparing cross-section drawings to J.I.C. Symbols

IX. Friction

A. Mechanical
B. Hydraulic
C. Discussion of fluids
(Problem 5 Determining cylinder bores and pump sizes)

X. Basic Circuits

A. Elementary circuits
B. Stop-start circuits
C. Pump unloading
D. Speed control
E. Pressure control
   (Problem 6 Determining hydraulic work)

XI. Circuit Development

A. Differential circuit
B. Accumulator circuit
   (Problem 7 Determining pump characteristics)

XII. Circuit Development (Continued)

A. Acceleration and Deceleration
B. Flow Control
   (Problem 8 Transmission characteristics)

XIII. Discussion of Hydraulic Standards
   (Problem 9 Design problem)

XIV and XV. Electrical Controls

XVI. System Accessories and Maintenance
A. Filters
B. Fittings
C. Tubing Selection

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## Training Courses in Fluid Power

**The Ohio State University,** Columbus, Ohio, Department of Mechanical Engineering: Hydraulic Machinery (applications and principles of their design); Industrial Hydraulics (principles and methods applied to industrial hydraulics, including power generation and transmission); Instruments and Controls (study of the instruments and controls commonly encountered in mechanical apparatus; one-half time given to hydraulic and pneumatic servomechanisms).

**Rensselaer Polytechnic Institute,** Troy, N. Y., Department of Mechanical Engineering: Dynamics of Liquids (emphasis on water, oils and liquid fuels); Hydraulics (including hydraulic machines).

**Oklahoma A & M College,** Stillwater, Okla. Civil Engineering Department: Fluid Mechanics; Hydraulic Laboratory; Hydraulic Equipment (special course on pumps, valves and operations) (undergraduate); Fluid Mechanics (graduate course, with emphasis on alternate methods of solutions of practical problems).

**Polytechnic Institute of Brooklyn,** Brooklyn, N. Y. Department of Mechanical Engineering: The Analysis and Design of Oil Power Hydraulics and Controls (graduate). This one term lecture and problem course is being extended to a full year. It has been given for the past five years. More than 120 students now working in the Metropolitan New York area have taken this course.

**Stevens Institute of Technology,** Hoboken, N. J. Department of Mechanical Engineering: Mechanics of Fluids; Fluid Mechanics Laboratory; Special Problems in Fluid Dynamics.

**Texas Technological College,** Lubbock, Texas, Department of Civil Engineering: Fluid Mechanics; Hydraulic Machinery.

**Vanderbilt University,** Nashville, Tenn. School of Engineering: Fluid Mechanics ((all students); Hydraulic Machinery (non-compressible fluids, pumping machinery, etc.).

**Virginia Polytechnic Institute,** Blacksburg, Va., Department of Mechanical Engineering: Fluid Mechanics; Hydraulic Laboratory; Hydraulic Machinery.

**University of Notre Dame,** Notre Dame, Ind., College of Engineering: Hydraulics of Machinery (offered as an elective at intervals).

**Rose Polytechnic Institute,** Terre Haute, Ind. All senior engineering students: Fluid Mechanics. The emphasis is on fundamentals.

**Rutgers University,** The State University of New Jersey, New Brunswick, N. J. College of Engineering: Fluid Mechanics; Fluid Mechanics Laboratory.


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PUSH-TYPE SOLENOID
Packingless—pressure balanced cartridge type pilot valve.
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Operating pressure 5 to 150 P.S.I.
Pilot-operating pressure 5 P.S.I. minimum.
No springs.
All valve action components and main valve body parts interchangeable.

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Designed to meet the new demands of industry. Available in choice of 4 bores—4", 5", 6" and 8" in the following ratios: 5:1 through 28.5:1. Air source of power boosted to a maximum of 2850 psi hydraulic working pressure for single and dual pressure circuits.

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**Denison Axial Piston Pumps.**
Hydraulically balanced, high-pressure, high-volume pumps in a range of sizes for circuits of 3000 and 5000 psi capacity... volume capacities 3.5 to 35 gpm. Constant volume, or variable volume with control by hand wheel, pressure compensation, stem, or cylinder. Face, flange or foot mountings. Catalogs P-4-1, P-4-2, P-4-3, P-4-10.

**Multi-Range Flow Controls**
permit full-scale regulation of flow for many different circuit needs, at pressures to 3000 psi. Infinitely adjustable within each range of control... cartridge-type single-spool design adjusts easily to various pump deliveries without changing spools. 2-port and 3-port types, with or without built-in check. ¼", ⅜" and ¾" sizes; 0 to 28 gpm capacities.

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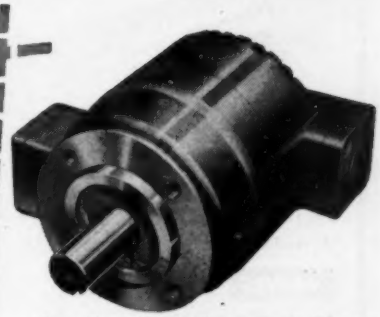
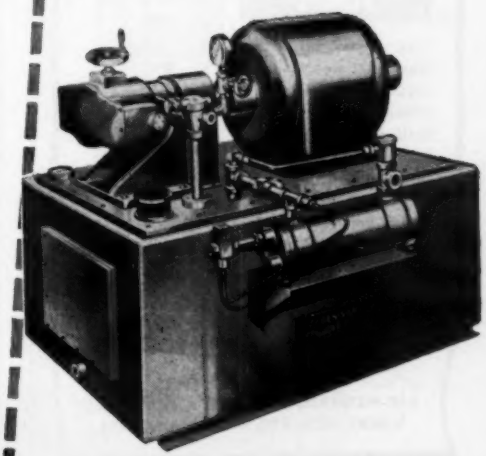


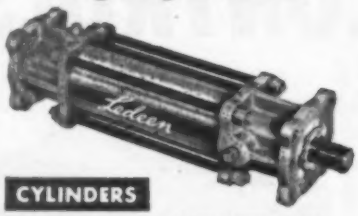
**Vane-Type Single-Stage Pump/Motors,**
built for continuous use at pressures to 2000 psi, are ready for either pump or fluid motor duty without alterations. Rotation of shaft can be either direction without internal adjustment. Four sizes, plus interchangeable cam rings, offer pumping capacities from 2½ to 70 gpm, or torque ratings from 13 to 257 inch-pounds per 100 psi. Catalog P-5.

**Denison Axial Piston Fluid Motors.**
Four sizes, with torque capacities ranging from 510 to 5585 inch-pounds (about 24 to 160 HP). Speeds to 2000 and 3000 rpm. Compactly built... largest size is only about one foot in diameter. For circuits of 2500 and 5000 psi. Catalogs FM-2 and FM-3.



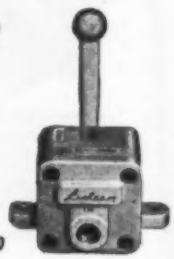
**Denison's Self-Contained Pumping Units.**
37 models cover any circuit need from 400 to 5000 psi and from 2 to 35 gpm requirements. Automatic water-cooled oil coolers or two-pass automatic heat exchangers available for extra heavy or continuous service. All operating components mounted on reservoir top in single-panel assembly, for easy removal as a unit. Catalogs PU3 and PU4.

Ledeen
PNEUMATIC & HYDRAULIC Equipment



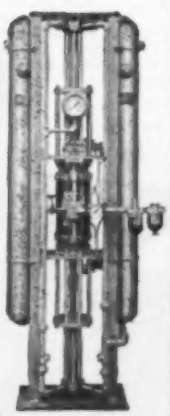
CYLINDERS
For air, oil, water, gas or steam operation—in standard and special diameters and stroke lengths.
*Write for Bulletin 500*

VALVES
For operating air and hydraulic cylinders and motors, single and double acting. Hand, foot, power and solenoid operated.
*Write for Bulletin 1000*



VALVE ACTUATORS
For power operation and remote control of line valves. Adaptable to most any make, size and type of valve, to operate against any line pressure, for any fluid medium, with any pressure.
*Write for Bulletin 512*

AIR-HYDRAULIC PUMPS
High pressure oil, from plant air supply. For clamping, drawing, forming, testing and other operations requiring long high pressure cycles without vibration or overheating. Ready for connection to plant air and hydraulic lines.
*Write for Bulletin 4000*



VALVES • CYLINDERS
AIR-HYDRAULIC PUMPS & BOOSTERS
VALVE ACTUATORS • AIR HOISTS

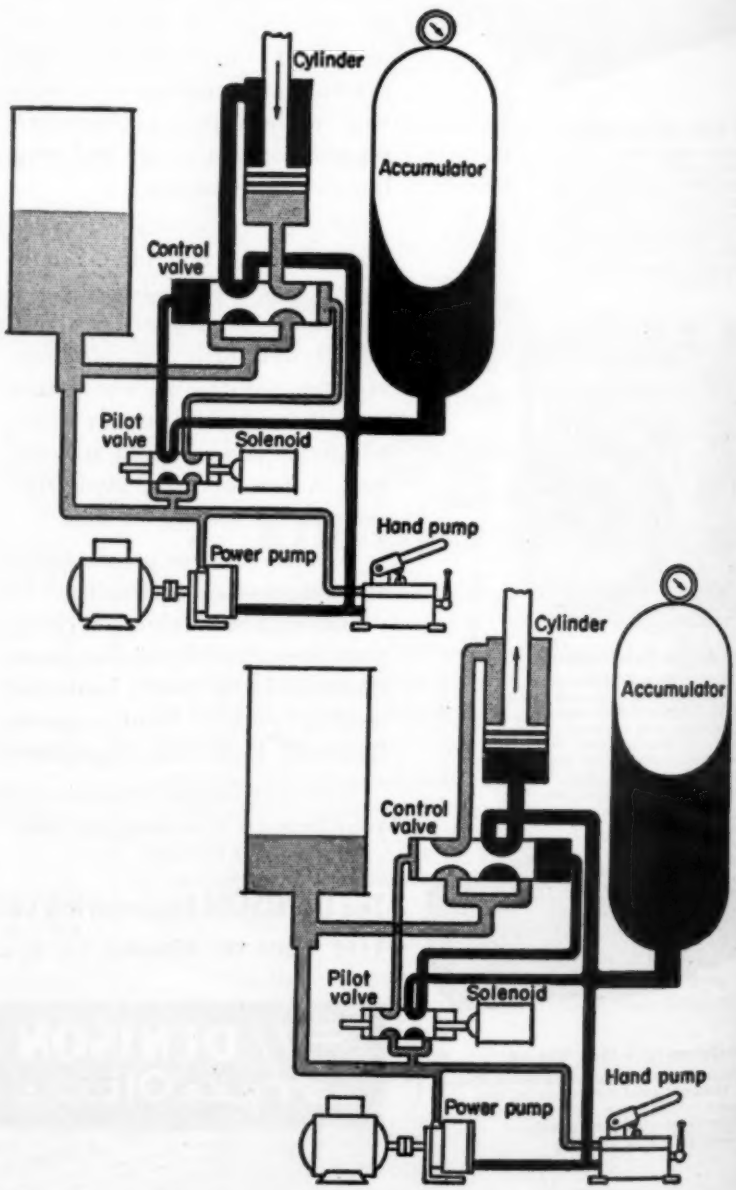
Ledeen Mfg. Co.
1610 So. San Pedro
Los Angeles 15, Calif.

# 175 Horsepower in ⅛ Second

**Circuit breaker is actuated by hydropneumatic accumulator circuit.**

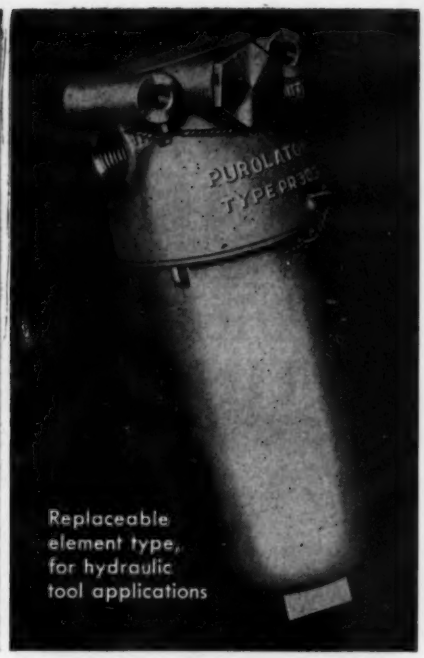
OPERATION of a modern high capacity circuit breaker requires an energy storage device which will release a tremendous quantity of energy in a very short period of time. For instance, the closing operation of a typical large circuit breaker may demand as much as 130,000 inch-pounds of energy delivered during ⅛ second. This means that approximately 175 horsepower must be available instantly.

To meet this energy demand, Allis-Chalmers has developed a hydraulic actuator which combines the advantages of pneumatic and hydraulic actuation. According to Allis-Chalmers engineers, the new hydraulic actuating system may be the forerunner of a new era in circuit breaker design. It could mean



For high-pressure systems

For medium-pressure systems in military and tool applications



Replaceable element type, for hydraulic tool applications

For aircraft hydraulic systems

For low-pressure high flow systems

# Eliminate the chief cause of valve and cylinder failure *with* PUROLATOR Hydraulic FILTERS

FLUID CONTAMINANTS, such as sludge, oxidation products and metal particles, are among the worst enemies of dependable performance in hydraulic systems . . . a fact that merits consideration in the *design* stage.

By including efficient Purolator* filters in *all* lines containing precision valves and actuators, you insure equipment against the stoppage and excessive wear that so often result from hydraulic fluid contamination.

Purolator filters, designed especially for hydraulic service, are available in a wide range of types and capacities to meet any requirement in new and existing equipment, both military and commercial.

And remember . . . whenever you specify Purolator, your choice is backed by the world's largest filter research and engineering laboratories, *plus* the world's largest specialized filter production facilities.

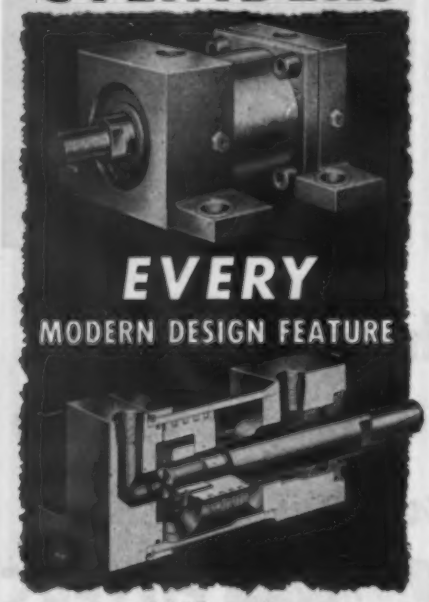
Send for the latest Purolator Filter Catalog, listing more than thirty different types, including A & N approved.

**Purolator Products, Inc., Rahway, New Jersey and Toronto, Ontario, Canada**
**Factory Branch Offices: Chicago, Detroit, Los Angeles**

*Reg. U.S. Pat. Off.

PUROLATOR
WORLD'S FINEST OIL FILTER

HYDRAULIC CYLINDERS



EVERY MODERN DESIGN FEATURE



- 2000 p.s.i.
- Compact design
- J.I.C. Standards
- 11 models in 11 sizes
- Up-to-date engineering
- All steel construction
- Wide choice of rod sizes
- Quick-change packing cartridge

S-P makes hydraulic cylinders for the world's largest corporations. Representatives in principal cities. Prompt deliveries. Send for copy of S-P Catalog No. 103.

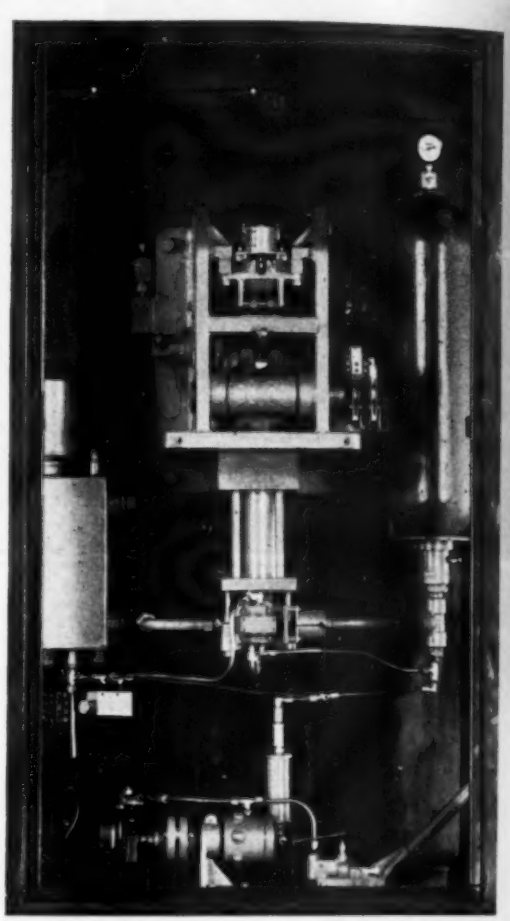
S-P AIR CYLINDERS

Famous for long life—low downtime. Piston packings "replace" themselves. Prompt deliveries. Send for Catalog 102.

OTHER S-P PRODUCTS: Power Chucks, Rotating Air Cylinders, Parallel Grip Collet Chucks, Drill Press Chucks, Expanding Arbors, Blank Jaws, Air Valves, Air Pistons, Air Control Accessories.

THE S-P MFG. CORP.
ESTABLISHED 1916
12415 EUCLID AVENUE
CLEVELAND 6, OHIO
A Bassett Company


## 175 Horsepower in 1/8 Second



**HYDROPNEUMATIC ACCUMULATOR releases the large energy requirement for a short time interval to actuate the circuit breaker. Pilot and control valves are connected to the base of the actuating cylinder, minimizing friction losses and tubing. Both the reservoir and accumulator have small capacities because the required volume of oil in the 3000 psi system is small.**

the replacement of mechanical linkages with tubes carrying an operating fluid, altered physical design of present power circuit breakers, and smaller and less complete controls.

### Types of Breakers

Modern pneumatic, spring, or solenoid actuated circuit breaker operators are the product of many years of continuous improvement. All of these types are adequately meeting the performance requirements expected of them within their application range. Thus any new operating method must offer basic improvements in simplicity, reliability, or maintenance to meet with general acceptance. At the same time it must equal or exceed present operators in reclosing and opening speeds and provide energy storage for the standard minimum of five operations.

While hydraulic systems are noted for their simplicity and adaptability, the problem of designing a system to operate a circuit breaker called for the solving of three major problems:

1. A means of energy storage capable of releasing a tremendous amount of energy for a short period, yet remaining reliable and unaffected by temperature variations.
2. A hydraulic valve of simple and rugged design able to insure the repetitive high speed of operation necessary for present and future ultra-high speed power circuit breakers.
3. A hydraulic system using a small enough volume of fluid to permit reasonable velocities, while maintaining maximum efficiency and a minimum physical size of components.

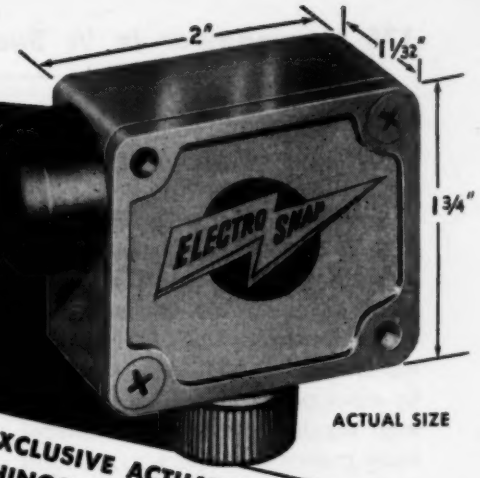
In the past, a means of storing energy had always been a hindrance in the design of a pure hydraulic operating mechanism. However, the development of the hydropneumatic accumulator and its subsequent widespread use has provided a very satisfactory solution to this problem.

If a hydraulic operator was to show any improvement in operating speed over the modern pneumatic operator, the time interval from closing coil energization to full open valve position of the main control

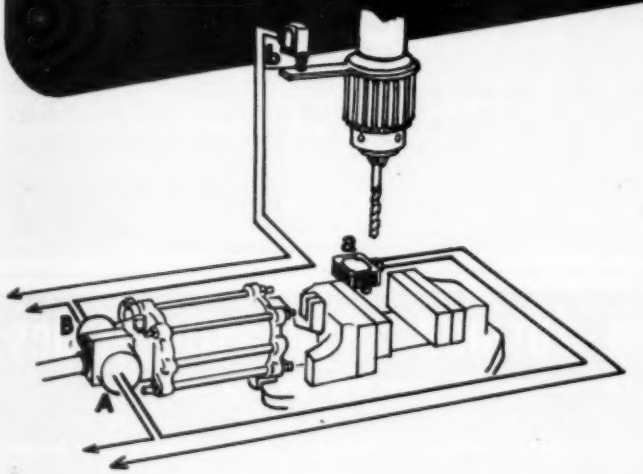
# NEW! ONE-WAY IMPULSE SWITCH

for AIR-HYDRAULIC CONTROLS

## *Eliminates Interlocking Switches and Complicated Actuating Dogs*




ACTUAL SIZE



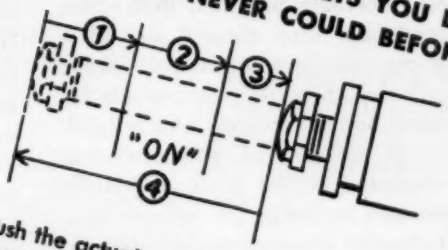

### SIMPLIFIES CIRCUITS

Only two Electro-Snap Impulse Switches and a double solenoid valve are needed to automatically open and close the air vise on this drill press, for example. Work positioned against Impulse Switch "a" closes vise by pulsing and momentarily energizing solenoid circuit "A". Raising drill after use operates second Impulse Switch "b" to pulse solenoid circuit "B" and open vise. No interlock switches, timers or relays.

### MORE DEPENDABLE CONTROL

Troublesome one-way dogs can be eliminated. Special cams and long actuating travel are not required. No delicate adjustments.

### EXCLUSIVE ACTUATOR LETS YOU DO THINGS YOU NEVER COULD BEFORE




**(1)** Push the actuator plunger this far and switch completes a circuit.

**(2)** (On Period)—Circuit remains closed as plunger is pushed through position 2.

**(3)** (Overtravel)—Circuit is opened and remains open for rest of plunger forward travel.

**(4)** Switch is not tripped on plunger return. Circuit stays open.

### LOWER COST, LOWER MAINTENANCE

With Impulse Switches, fewer switches are necessary. Electro-Snap Impulse Switches are $12 to $25 cheaper than timers and other switches which can do the same job. Simplicity of controls makes maintenance easy. You don't need engineers or electronic specialists.

### FASTER AUTOMATIC OPERATION

Automatic machines can run faster because cycles can be more closely sequenced. There's no delay due to timer tolerances or extra machine motions to actuate interlock switches.

**TRY THIS NEW SWITCH ON YOUR CONTROL JOB**

SEND YOUR STANDARD PURCHASE ORDER

*Ask for discounts on quantity purchase*

**$10.50**

plus $.25 to cover shipping costs

### SPECIFICATIONS

**Housing**—Switch and actuating mechanism enclosed in diecast case. Splash-proof boot protects actuator plunger.

**Wire Outlet**—Integral conduit boss with standard ½"—14 standard pipe thread.

**Mounting**—Two No. 8 screws through case.

**Capacity**—UL rated at 10 amps, 125/250v AC.

**Pretravel** 0.05".

**Movement Differential** 0.022".

**Operating Force** 3½ lbs.

| MODEL NO. | Overtravel | On Period (or in. of plunger travel) |
|---|---|---|
| ES4-KM1 | 3/8" | 1/16" |
| ES4-KM2 | 5/16" | 1/8" |
| ES4-KM3 | 1/4" | 3/16" |
| ES4-KM6 | 1/16" | 3/8" |

ELECTRO SNAP

**ELECTRO-SNAP SWITCH AND MFG. COMPANY**

4224 WEST LAKE STREET CHICAGO 24, ILLINOIS

valve had to be kept to an absolute minimum. A solenoid with sufficient force to rapidly move the large control valve would have an excessively long flux build-up time. This characteristic prevented the use of a direct-connected solenoid operated valve. A small pilot valve, actuated by a low power high speed solenoid and regulating the main control valve proved a satisfactory solution to this problem. This pilot arrangement not only provided high valve speeds but also allowed use of a simple, low current control circuit.

Choice of operating pressures becomes one of economy and reliability. A pressure of 3,000 psi was found to be the most acceptable pressure to use at the present time. Hydraulic components suitable for 3,000 psi systems are standard and well proven as to reliability in service.

Tube size was determined by an oil volume and velocity relationship. In order to keep component sizes and weights down, the flow velocities used are considerably above those ordinarily employed for continuous flow application, but because of the short time intervals involved the total pressure drop in the system is less than 5 percent. All oil lines are kept as short as possible and with smooth bends where needed.

## Circuit Operation

The flow of oil and action of the circuit is shown in the schematic. Normally the ram is at the lower limit of its travel and both valves are to the right. Energizing the solenoid snaps the pilot valve spool to the left and allows oil from the accumulator to surge into the right hand chamber of the control valve, forcing that spool to the left so that high pressure oil rushes in under the piston of the cylinder, driving the ram upward to close the breaker.

As the ram closes the breaker, it trips a limit switch opening the solenoid circuit. A spring contained in the solenoid instantly returns the pilot valve spool to the right and high pressure oil surges through the pilot valve into the left chamber of the control valve, forcing the control valve spool back to the right and allowing oil from the accumulator to rush in above the piston, driving it back to the original position to complete the cycle.

On the upward stroke oil above the piston, and on the downward stroke oil under the piston, is exhausted through the control valve to the reservoir at atmospheric pressure. The oil in the chamber of the control valve toward which the spool moves is exhausted through the pilot valve to the reservoir also. The reservoir contains a baffle arrangement to reduce the aeration of the oil. Since the reservoir is at atmospheric pressure, there is no pressure build up to cause valves or ram to creep. The gravity fed power pump automatically maintains pressure in the high pressure and accumulator circuit within the operating range.

*This article was prepared from a paper by N. W. Morelli and E. R. Perry, Circuit Breaker Engineering Section, Allis-Chalmers Boston Works.*

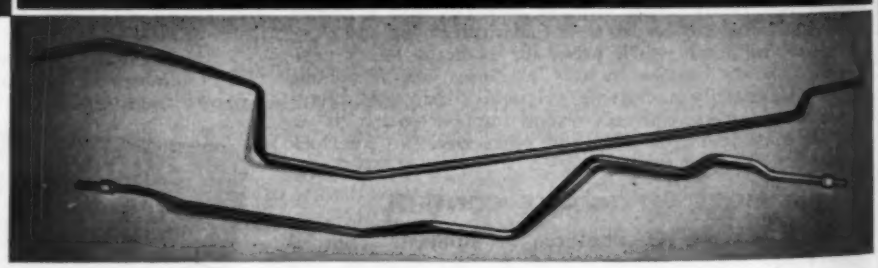
Precision-formed Hydraulic Lines

FACTORY MADE TO YOUR OWN SPECIFICATIONS

with . . . compound bends . . . complete fittings . . . any shape, size or length

eliminates . . . costly pipe work . . . costly pipe connections . . . costly leaks

-and saves you time and money



FORMRITE factory formed tubing can be produced in any length or shape, and with or without standard JIC fittings. All FORMRITE fittings meet ASME Code for Pressure Piping Specifications, as well as JIC and SAE Standards.

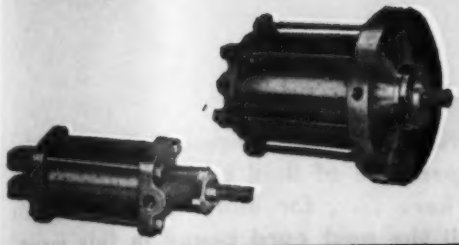
PRODUCTION: Superior FORMRITE tooling and production methods assure exact radii specified, with no flattening or wrinkling of the tube at the bends. All Hydraulic lines are cleaned and plugged to assure dirt free tube. Steel tubes can be zinc plated to prevent rusting. Finished parts are checked in steel jigs, and careful inspection guarantee delivery to your exact specifications.

FORMRITE FITTINGS: We can supply a complete line of high pressure pipe fittings, and flare type tube fittings that meet ASME, JIC and SAE Standards. The fittings are available in all standard shapes and a wide variety of sizes. Special designs can be furnished when required.

WRITE FOR CATALOGS DESCRIBING FORMRITE'S COMPLETE LINE OF HIGH-PRESSURE FITTINGS AND TUBE FORMING SERVICE.

FORMRITE TUBE CO.

TWO RIVERS . DEPT. B . WISCONSIN



## Pneumatic Cylinders

Really complete, the Hannifin line of pneumatic cylinders is made in twelve bore sizes, 1″ to 16″, and in six standard mountings, many combination mountings. Really standard, these cylinders are tooled to tolerances that assure accurate mounting to make assembly to your machines easier. Really built, each cylinder is "TRU-BORED" and honed, piston rods are ground and polished, interchangeable end caps, heavy duty tie rods . . . rugged, yet precision construction throughout!

# NOW . . .

## HANNIFIN HAS THE MOST COMPLETE LINE OF AIR CONTROL EQUIPMENT!

**Write for Bulletin 210**

## NEW! REVOLUTIONARY HANNIFIN *P-M Pilot-Master Valves*

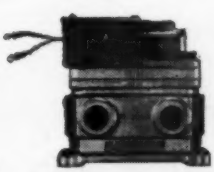
Piston-operated poppet design. Exclusive replaceable cartridge for easier maintenance. Speeds to 600 cycles per minute. Pressure from 15 to 150 p.s.i. Integral, solenoid-controlled pilot heads or a choice of 10 separate pilot valves for remote control.

- Fewer Valves to Stock
- Fewer Parts to Stock
- Maximum Interchangeability
- No Springs in Main Valve

**Write for Bulletin 231.**

**2 and 3-Way Valves.**

Same valve operates 2-way or 3-way, normally open or normally closed. ⅜″ to 1¼″ I.P.S.



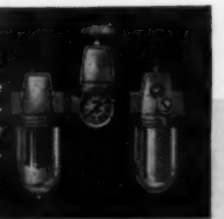
**4-Way Valves.**

Two 3-way valves mounted in compact, common body. Two piston poppets. Two cartridges. ⅜″, ½″, ¾″ I.P.S.

***EXCLUSIVE REPLACEABLE CARTRIDGE***

**AIR WARDEN**

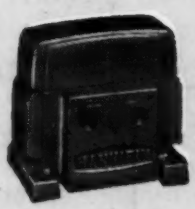
Air filters, pressure regulators and lubricators to protect air operated equipment. Bulletin 10108.



## Disc Type Air Control Valves

**Designed for smooth, positive and accurate control of air-operated equipment. Bronze discs lapped to perfect seal with seats. Packless design. For hand, foot or electrical operation. Sizes: ⅛″ to 1¼″ I.P.S.**

**Write for Bulletin 57-W**



**Hannifin "Directair" electrically controlled air-operated disc valve**

**Foot-operated treadle valve (Also spring return and rotary types)**

**Standard hand control valve (Single or duplex)**

# HANNIFIN

**Hannifin Corporation, 1155 S. Kilbourn Ave., Chicago 24, Ill.**

**Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves**

# NEW PRODUCTS

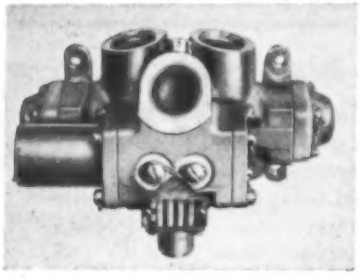
**Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.**

Continued from page 30

### *HYDRAULIC PUMP MOTOR*
### *. . . for jet bombers*

**Design:** Air-cooled 3½ hp hydraulic pump motor, rated at 7500 rpm, supplies hydraulic power for control of aircraft's tail assembly, and in the wing serves as a standby source of power where the jet engine is the primary source. Of the ducted type, the motor employs an air-through design which utilizes a built-in blower to draw ambient air from outside the plane, circulate it through the brushes and windings and expel it from the pulley-end stack. Will circulate air from —65 F to 135 F at altitudes approaching 50,000 feet. Explosion-resistant through the use of two blower tubes connecting via ducts to the outside air. The motor has a three-to-one gear reduction and is equipped with a radio noise filter.

**General Electric**
**Schenectady, N. Y.**
Circle 233 on Reader Service Card



### *4-WAY VALVE*
### *. . . for jet aircraft*

**Designation:** Part No. 28161.
**Design:** Spring offset, two position, solenoid operated, four way valve using engine oil to operate hydraulic cylinders.
**Specifications:** Ambient temperature range —65 F to 350 F; operating pressure 3000 psi; ports available in ¼, 5/16, ⅜ and ½ in tube sizes; operating voltage 18-30V DC; current required 1.0 amp at 30 volts; continuous duty solenoid; pilot valve spring loaded against pressure to 4000 psi min.; weight 1.75 lbs.

**Adel Division of**
**General Metals Corporation**
**Burbank, California**
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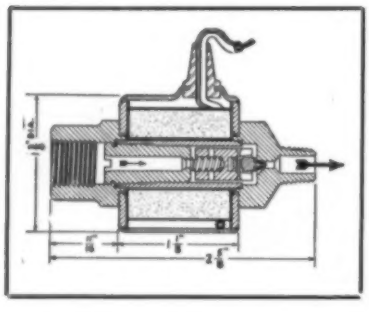

### *SOLENOID VALVE*
### *. . . without gaskets*

**Design:** Solenoid valve having major parts of stainless steel, silver brazed for rigidity, with no gaskets being used. Has a special strain relief lead wire grommet, with plunger of minimum size and weight to insure operation under heavy vibration. Floating synthetic rubber needle valve insures positive closing.
**Specifications:** Operates up to 1000 cycles per minute; pressure up to 200 psi; straight-through flow; weight 5 oz; power consumption 1 to 3 watts. Available in 6, 12, 24 volts DC and 100 volts AC, with special voltages on request.

**Specialty Products Co., Inc.**
**Minneapolis, Minn.**
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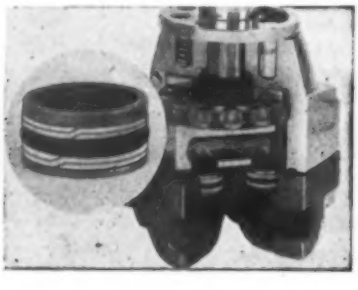


### *SPIRAL BACK-UP RINGS*
### *. . . protects "O"-rings*

**Designation:** Series SR-6144, SR-7234 and SR-2619. Kelon -T (Teflon -tetrafluoroethylene resin)
**Sizes:** Available in 153 sizes ranging from 0.125 to 15.50 in ID.
**Features:** With very low friction, the chemically inert spiral packings will not swell, shrink, harden or soften, and are unaffected by acids, oils, or bases or solvents. Useable temperatures range from —110 F to 300 F.

**W. S. Shamban & Co.**
**Culver City, California**
Circle 236 on Reader Service Card

# AIR FORCE'S HEAVY PRESS PROGRAM!

*By courtesy of "The Aeroplane."*

**THE LOEWY CONSTRUCTION CO.**
50,000 ton press.
35,000 ton press.
**RELY ON 'LION'**

**THE MESTA MACHINE CO.**
50,000 ton press.
**RELY ON 'LION'**

**THE UNITED ENGINEERING & FOUNDRY CO.**
35,000 ton press.
8,000 ton press.
**RELY ON 'LION'**

## *Monster Presses....*

## RELY on 'LION' SHALLEX & TWO-LIP PACKINGS

The world famous manufacturers of these gigantic presses, the largest ever to be built, insist upon the highest degree of packing performance and efficiency. Their choice of "Lion" SHALLEX and TWO-LIP PACKINGS acknowledges the outstanding merits of these two products, and the world wide reputation Walkers have earned by placing quality and service foremost.

***YOU TOO — CAN RELY ON 'LION'***

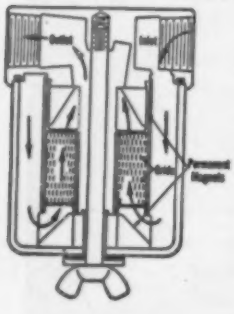
*To learn more about the Packings used on these monster presses write for fully illustrated literature to Dept. 10*

**The JAMES WALKER PACKING CO. INC.**
6924, SOUTH HALSTED STREET, CHICAGO 21, ILL.
Telephone: Aberdeen 4—1180 Telegrams: Lioncelle

WALKER'S LION PACKING

Keep hydraulic lines free from ferrous particles that cause sticking and non-functioning of finely fitted valves; help prevent damage to pumps, pistons, cylinders, gears and other parts subject to wear.

Cross section shows flow of liquid through a stack of "honeycomb" grids strongly magnetized by Alnico permanent magnets. Even the finest magnetic particles are extracted. Easy cleaning: unscrew tie rod, drain, remove and wash grids and reassemble. No replacement cartridges to buy.



**Send for BULLETIN PM-65**

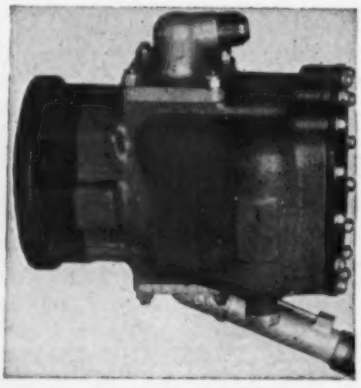
**S. G. FRANTZ CO., Inc.**

P. O. Box 1138 Trenton 6, N. J.




### AIRCRAFT PUMPS ... have large variable delivery

**Designation:** Model PV-3918
**Rating:** 3000 psi; 2.349 cubic inches per revolution.
**Features:** Overspeed control, automatically limits the maximum pump delivery and accordingly provides another safety check on cabin compressor impeller speed.



**Application:** Powers each of two cabin compressors which supply air to the DC-7 air conditioning system.

**Vickers Incorporated**
**Detroit, Mich.**

Circle 237 on Reader Service Card

### MAGNETIC PICK-UP ... for temperatures to 500 F

**Designation:** Model 3010-HT
**Specifications:** Output up to 28 volts; resonant frequency 50,000 to 60,000 cps; impedance 500 ohms at 1000 cps; body, stainless steel; connector, amphenol type 80C1; dimensions, 2 x ¾ in with

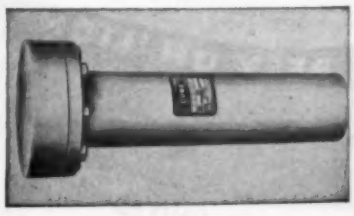
⅝-18 mounting thread. Threaded portion 15/16 in long; weight, 2 oz.
**Operation:** Converts mechanical motion to electrical energy while operating at temperatures as high as 500 F. Operates without physical contact or loading when mounted near any moving magnetic material and generates a voltage output proportional to the rate of motion or speed of any metal object with magnetic properties.
**Applications:** For indicating RPM, operations, cycles, angular, linear motion. Actuates electronic counters. Serves as tachometer when used with voltmeter. Controls electrical devices when used with amplifiers and relays. Trips Thyratron circuits for flashing light with rotating machinery. Provides synchronizing voltage for oscillograph; markers for angular or linear position in measuring displacement.

**Electro Products Laboratories, Inc.**
**Chicago, Illinois**

Circle 238 on Reader Service Card

### LIQUID AND GAS FILTERS ... for high pressure systems

**Designations:** Series 1H and 1HG
**Design:** Standard units are available for operating pressures up to 1000 psi. Filters designed for even higher pressures are available.
**Specifications:** Pipe sizes for inlet and outlet connections are



⅜, ½ and ¾ in. Guaranteed degrees of filtration are 10, 25, 50, and 75 microns (.000394 to .0029 in). Maximum capacity for liquid at 150 SSU, 2 lbs pressure drop and 50 micron degree of filtration is 15 gpm. For gases at 1000 psig, 2 lbs. pressure drop and 25 micron degree of filtration maximum capacity is 200 SCFM (Free Air).

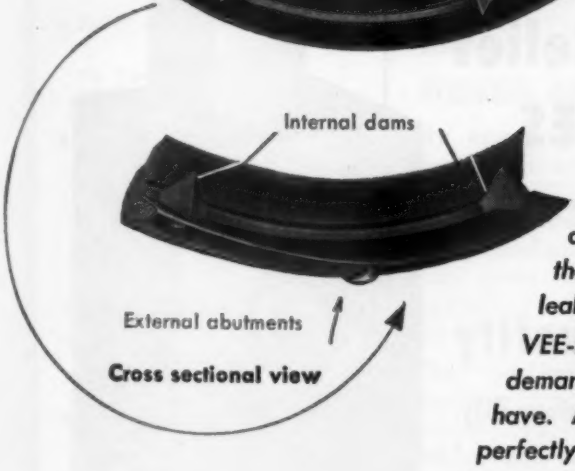
**Cuno Engineering Corporation**
**Meriden, Conn.**

Circle 239 on Reader Service Card

**Greatest Giant**
in Lockheed Aircraft's
"Hall of Giants" is this 8000-ton
Birdsboro deep-draw press...
the largest of its type in the world.
Its big main rams, in keeping with
their advanced design, are sealed
with LINEAR VEE-DAM Rings,
the most effective modern hydraulic
packing ever developed!

**Foolproof to assemble**
**Leakproof in operation**

# LINEAR VEE-DAM RINGS




**Cross sectional view**

*The unique design of LINEAR VEE-DAM Rings makes possible, for the first time, a split "V" ring packing that is really leakproof . . . ideal for hydraulic presses, pumps and pneumatic equipment.*

*A look at the close-up view of a VEE-DAM Ring will tell you why they seal so effectively. Those sturdy rubber dams, faced in opposite directions, are moulded into the groove hinge area of the ring, completely eliminating leakage between rings.*

*VEE-DAM Rings are easier to install because they don't demand the precise fitting that ordinary rings should have. And they last longer, too, because they seal perfectly tight with a minimum gland load.*

*Made of a choice of fabric reinforced synthetic rubbers, LINEAR VEE-DAM Rings are individually engineered for your application. Write or call LINEAR for complete information.*

"PERFECTLY ENGINEERED PACKINGS"

**LINEAR**

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.



Circle 113 on Reader Service Card

### LUBRICATION SYSTEM
***. . . operates on compressed air***

**Designation:** Oil-Air
**Features:** No moving parts; it operates solely on compressed air; atomizes oil into microscopic particles which are carried in the air-stream and distributed through tubing to the

bearings. Compressed air enters the unit at 100 psi, passing through the regulator, the pressure is reduced to 10 psi. As the oil passes through the venturi, it draws the oil from the reservoir. Amount of oil flow is adjustable.
**Construction:** Consists of solenoid valve, filter, water separator, regulating valve, lubricator, reservoir, pressure switch and low-level indicator.

**Application:** Automatic oiling system for plain bearings, ball and roller bearings, vees, slides, ways, rollers, cams, chains, gears and transmissions.

**J. N. Fauver Company**
**Detroit, Michigan**

**Circle 240 on Reader Service Card**

### PISTON PUMP
***. . . for low volume application***

**Features:** Two models, fixed delivery type and variable delivery type. Pumps offer absolute positive action at the slowest speeds; delivery characteristics unaffected by variation in viscosity, feed or back pressure; completely self-lubricating, ensuring capacity to run for long periods without attention; no idle pockets or passages to cause air locks or permit coagulation, the path of the fluid through the pump is

simple and unidirectional, and is fully and constantly swept by the current of fluid passing; no aeration or agitation of the fluid; no messy leakage; all parts made to fine limit gauges, ensuring low cost or re-conditioning.

**Davies Brothers**
**New York, N. Y.**

**Circle 241 on Reader Service Card**

**Announcing...A NEW Line Of FLUID CONTROLS 3/4" Relief Valves at NEW LOW PRICES**

**Farm Machinery Prices for Machine Tool Quality**

- No need to sacrifice quality on even the most reasonably priced equipment.

*Write for data, specifications, and prices.*

• For Oil • Relief Pressure — Adjustable 50 to 300 P. S. I. • Total over all size 2" x 2" x 5¼"

**Fluid Controls, inc.**

**Manufacturers of Hydraulic Valves and Devices**
Relief Valves • Check Valves • Restrictor Valves • Needle Valves • Pilot Check Valves • Clamping Valves • Small Spring Loaded Accumulators • Special Valves

1284 N. CENTER STREET MENTOR, OHIO

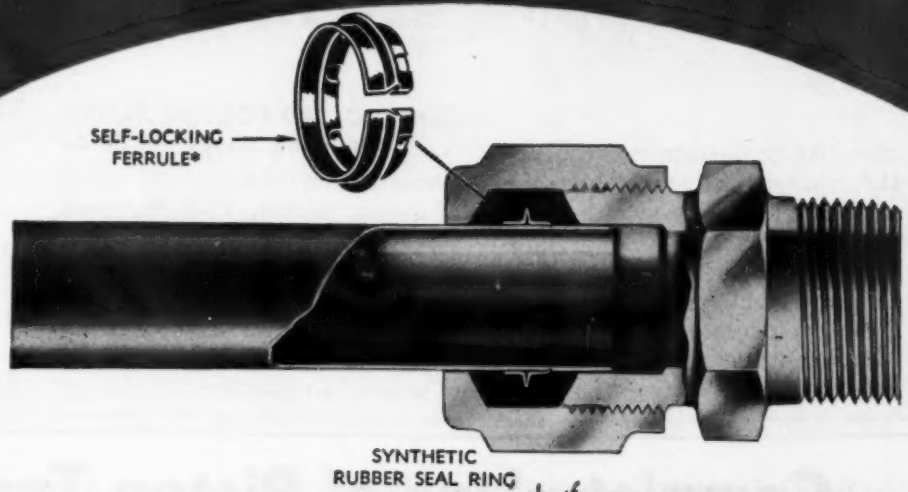
## ROLL CALL OF SEALASTIC USERS

- **AIRCRAFT ENGINES**
  - Allison Division—General Motors Corp.
  - Bendix Products Division—Bendix Aviation Corp.
  - Pratt & Whitney Aircraft—Division United Aircraft Corp.
  - Wright Aeronautical Corp.—Division Curtiss-Wright Corp.
- **AUTOMOTIVE**
  - Buehl Manufacturing Co.
  - Continental Motors Corp.
  - Ford Motor Company
  - Packard Motor Car Co.
- **BUSES**
  - ACF Brill Motors Co.
  - Canadian Car & Foundry
  - General American Aerocoach—Div. General American Transportation Corp.
  - Twin Coach Co.
- **FOOD PROCESSING**
  - The Liquid Carbonic Corp.
- **MACHINERY**
  - Allis-Chalmers Mfg. Co.
  - Detroit Diesel Engine Division—General Motors Corp.
- **OIL WELL MACHINERY**
  - Cardwell Mfg. Co., Inc.
- **RAILWAY**
  - The Budd Company
  - Electro-Motive Division—General Motors Corp.
- **REFRIGERATION**
  - Howe Ice Machine Company

# THESE NOTABLE NAMES IN AMERICAN INDUSTRY DEPEND ON . . .

# Sealastic

## ALL-PURPOSE FITTINGS




## THE FITTING THAT IS SHOCK ABSORBING AND VIBRATION-FATIGUE PROOF FOR LOW, MEDIUM AND HIGH PRESSURES

**By eliminating metal-to-metal contact** between tube and fitting, SEALASTIC ends your problem of leaks and breaks caused by shock and vibration-fatigue. Overcomes tube misalignments. Permits dependable, cost-saving, straight-line-tubing between fixed points.

**This cushioned-coupling design** provides a seal ring of synthetic rubber, surrounding a ferrule (either self-locking or solid ring swaged, sweated or brazed).

Seal ring prevents metal-to-metal contact and cushions against vibration. Nut only needs to be tightened by hand to place entire seal under compression (to withstand pressure up to 4,000 p.s.i.).

**Substantial time and labor savings in assembly work or emergency repairs** are made possible because Sealastic Fittings are engineered and integrated to your special requirements.

The varied industries listed at the left are proof of Sealastic's practical application wherever fuel, oil, water, refrigerants, air or ether injection must pass through metal tubes or piping.

May we send you descriptive booklet and full details of Sealastic engineering service?

*For critical applications, we recommend the solid ferrule fixed on the tube.

## CHICAGO FORGING & MFG. CO.

*Automotive Parts Manufacturer since 1922*

2000 SOUTHPORT AVENUE • CHICAGO 14, ILLINOIS

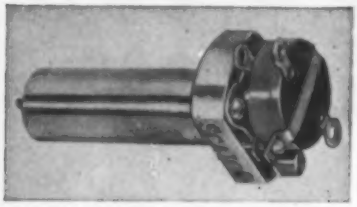
***SOME TERRITORIES STILL OPEN FOR SALES REPRESENTATIVES***

Continued

### THERMOSTAT
**. . . with snap action of contacts**

**Designation:** No. 3-C1200 Temp-switch

**Design:** The entire assembly is quite small. Weight is 1.2 oz. Principal of operation is the thermo-sensitive liquid fill in the



case. As temperature increases, the plunger actuates the snap action switch. The switch is designed with terminals for connecting direct-contacts open on increase or reverse-contacts close on increase. See specification for other details.

**Specifications:** Fits into ½ in hole, various means of securing. Snap action-SPDT. Differential —4 F. Direct and reverse acting switch. Underwriters Laboratories approved rating 10 amp, 115 AC, 5 amp 230 AC. also DC. Ranges 70 F to 150 F standard. Others up to 300 F.

**Applications:** Developed for close and accurate control where conditions require snap action of contacts.

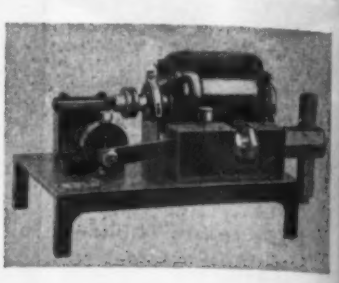
**Scaico, Inc.**
**Palmyra, New Jersey**

Circle 242 on Reader Service Card

### CONTROLLED VOLUME PUMPS
**. . . for wide range of fluids**

**Construction:** Pumps are made of brass, nickel, 18-8 stainless steel, plastic, hastelloy, C and B monel, cast iron and steel—any material to meet the need.

**Features:** Deliver exact quantities of an extremely wide range of products regardless of change in discharge pressure. Liquids can be delivered in quantities as low as 3 milliliters per hour to as high as 50 gallons per minute



against pressures to 20,000 psi.

**Applications:** Used on continuous process work in chemical plants; in boiler feed water, sewage and industrial water treatment; in blending and formulating operations; automatic pH control and automatic control of flows.

**C C. Pump Mfg. Div.**
**Palmyra, New Jersey**

Circle 243 on Reader Service Card

### ROD PACKINGS
**. . . impregnated with Teflon**

**Specifications:** Industrial rod

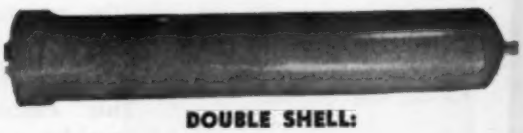

# Complete Line of Piston Type . . .
# CYLINDRICAL ACCUMULATORS

**SINGLE SHELL:**

SUPERIOR single shell cylindrical accumulators for operating pressures to 5000 psi are produced from 10 cu in to 350 cu in. Hundreds of successful industrial and arsenal applications. Low weight, compact design; high reliability and long life at economical cost.

Single shell accumulators conforming to MS-28700 are available for aircraft use.

SUPERIOR double shell cylindrical accumulators for hydraulic working pressures to 3000 psi are available in sizes from 5 cu in to 10 gallons. Case records of installations prove that heavy duty hydraulic power cycles, both for continuous and for intermittent service, are most economically provided with piston accumulators.



**DOUBLE SHELL:**

*Certified by Aetco—no oil leakage into air chamber; no external leakage; no evidence of excessive wear or malfunction.

The SUPERIOR piston type cylindrical accumulator was the first designed for industrial use whose test performance excells the MIL spec for Type II Piston Type Accumulators (MIL-A-5498B).

The certified performance* of Superior Cylindrical Accumulators is assurance that your design or operating margin is SAFER WITH SUPERIOR.

Several desirable territories for established sales-engineering representatives are open.

Superior **HYDRAULICS DIVISION**

**SUPERIOR PIPE SPECIALTIES COMPANY**

2917 S. Cicero Ave., • Phone Bishop 2-1313, • Cicero 50, Illinois
Cleveland, Ohio • Kenmore 1-9382

Circle 171 on Reader Service Card

# HYDRAULIC CONTROL OF AIR CYLINDER OPERATION GIVES ABSOLUTE SMOOTHNESS OF PISTON ROD MOVEMENT

WITH THE Bellows Hydro-Check you can combine the speed, economy and flexibility of air power with the smoothness of hydraulic operation. The Bellows Hydro-Check eliminates the natural "bounce" or "springiness" of air, gives an air-powered piston rod unparalleled smoothness with complete freedom from chatter.

In work or tool feeding operations the Hydro-Check can be set to provide hydraulic control of the feed rate through the entire stroke or at any given point without affecting either rapid advance or rapid return.

The Bellows Hydro-Check, while designed primarily for use with Bellows "Controlled-Air-Power" Devices, can be used with any conventional air cylinder. It proves equally effective in providing a controlled feed rate in manual feeding operations.

*Write for Bulletins HC-600 and CL-50. See how effective this positive control of pneumatic operations can be to you. Address Dept. AH-1053, The Bellows Co., Akron 9, Ohio*

## The Bellows Co.

AKRON, OHIO

*Controlled Air Power*

696A

**FOR FASTER, SAFER, BETTER PRODUCTION**

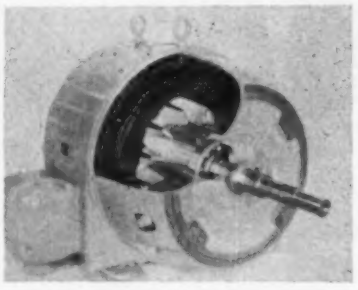
Continued

packings of braided asbestos, using as impregnation of 35 percent Teflon (tetrafluoroethylene resin). Two types can be supplied. White asbestos impregnated with the resin designed for dilute acids, caustics and various chemicals on centrifugal or reciprocating pumps and valve stems. The blue asbestos is recommended for use on similar installations where acids and chemicals of higher concentration are handled. It will perform satisfactorily in all temperatures ranging from —90 F to 500 F.

**United States Rubber Company**
**New York, N. Y.**
Circle 244 on Reader Service Card

### ELECTRIC MOTORS
**. . . for pump drives**

**Designation:** Type SCB
**Sizes:** Up to 60 hp
**Features:** Eliminates shaft alignment or pump mounting problems by supporting the pump on its NEMA style "C" registered mounting bracket. A step shaft, with special diameter, shoulder and tapped hole for mounting the impeller, has all ground diameters for precision assembly and sealing against

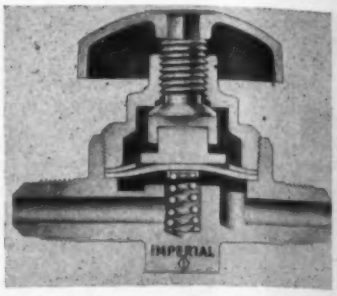


leakage. Grease lubricated ball bearings are ample to carry the thrust of centrifugal pumps. Motors have asbestos-protected windings, lubriflush lubrication of bearings and normalized castings.

**U. S. Electrical Motors, Inc.**
**Los Angeles, Cal.**
Circle 245 on Reader Service Card

### SHUT-OFF VALVE
**. . . for vacuum service**

**Designation:** "Red Head"
**Sizes:** Available with 45 degree




flare or solder connections in a size range from ¼ to ⅞ in OD and in ⅜ and ½ in female pipe thread sizes.
**Features:** Packless valve with Teflon diaphragm. Soft seat, valve provides positive shut-off with finger-tip operation. Designed to withstand unlimited openings and closings. Inlet and outlet ports are in line, simplifying installation. Valve body is brass forging.
**Application:** For vacuum instrumentation, processing, pneumatic service and similar indus-

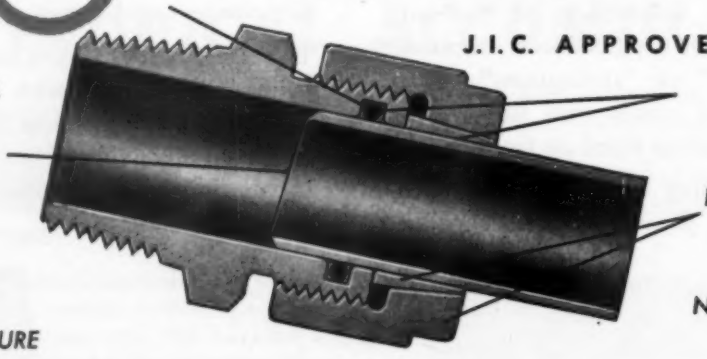

# the LENZ "O-RING" TUBE FITTING

J.I.C. APPROVED

NO METAL TO METAL SEAL

NOT NECESSARY TO CUT TUBE SQUARE

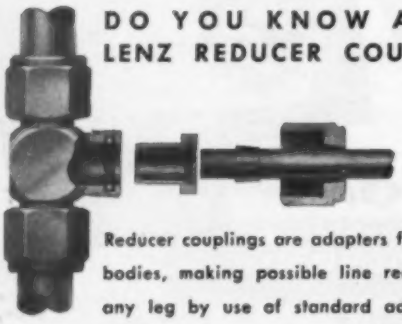
NO CONCENTRATION OF STRESSES DUE TO FLARES OR FERRULES FOR TUBE FAILURE



SEAL AND GRIP ARE SEPARATE

HELD BY FRICTION GRIP OF THESE TWO

NO EXACT TUBE LENGTH NECESSARY



DO YOU KNOW ABOUT LENZ REDUCER COUPLINGS?

Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

A HACKSAW AND A FILE IS ALL YOU NEED

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. The higher the pressure the tighter the grip. Solve your hydraulic piping problems the easy way . . . with ease of assembly . . . no matching of exact tube lengths . . . simple leakproof connection for the life of the tube.

Reusable collett holds by friction grip up to bursting pressure of tubing.

● LENZ FITTINGS MAKE THE JOB AS SIMPLE AS A B C

LENZ COMPANY

Box 1044-A • Dayton 1, Ohio • ME. 2557 — MI. 7985

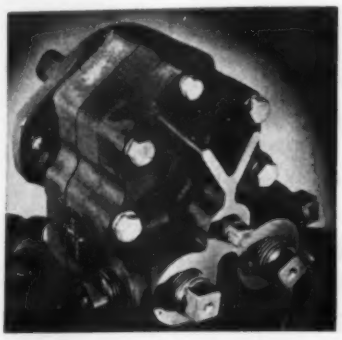
trial uses. Recommended for pressures up to 3000 psi and holds ultra high vacuum. Temperature range is —100 F to 450 F.

**The Imperial Brass Mfg. Co., Chicago, Ill.**

Circle 246 on Reader Service Card

### GEAR PUMP
### . . . designed for mobile equipment

**Designation:** HC Series.
**Features:** Shaft design permits these pumps to be direct, gear or belt driven. A wide selection of porting locations is available. End or side porting is standard.



Units may be had with an internal relief valve which permits regulation of pressures between 500 and 1200 psi, but cannot be used as a control or pressure regulating valve.
**Sizes:** Available in three sizes with capacities ranging from 5.4 to 10 gpm at 1800 rpm and a pressure of 1000 psi.
**Applications:** For use with agricultural implements, tractor loaders, industrial trucks, machine tools, agricultural and industrial power steering systems and construction machinery.

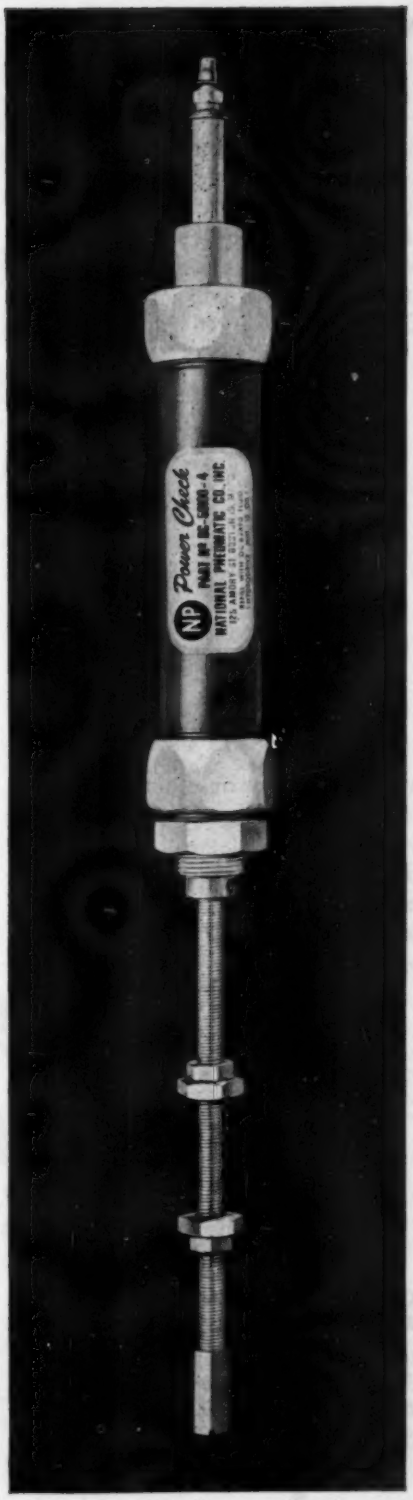
**Webster Electric Company Racine, Wisconsin**

Circle 247 on Reader Service Card

### AIR VALVES
### . . . with Nylon port exchanger

**Features:** Valves are of D-slide type, with port exchanger slide being operated by a double acting cylinder in one series and by a spring return cylinder in another series. The Nylon port exchanger has been service tested to 50,000,000 cycles and found to be undamaged, as was the pilot cylinder assembly which


# What do you want CONTROLLED with this new NP Power-Check?



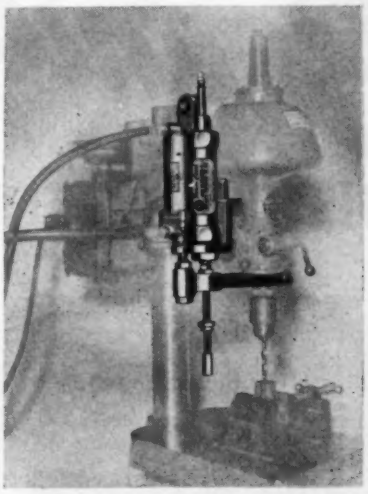

Now you can have precision speed control of any manually- or pneumatically-powered straight line motion.

National Pneumatic's new POWER-CHECK introduces and maintains a precise and uniform control *hydraulically* for all or part of the stroke.

The degree of "power-checking" is predetermined and adjustable. Eliminates the need for special skill. Completely self-contained — easily applied — requires almost no maintenance. 2, 4, 6, 8 inch strokes.

*What's your application?*

**FREE BULLETIN** No. DC-208-B. Write National Pneumatic Co., Inc., 125 Amory Street, Boston 19, Mass.



**POWER-CHECK,** applied to *manually-operated* or *pneumatically-operated* equipment, "smoothes out" power *hydraulically.* Typical applications: drill presses, grinders,

NP **POWER-CHECK**
**National Pneumatic Co., Inc.**
**Boston 19, Mass.**

**DISTRIBUTORS — ATTENTION.** A few of the best industrial areas may become available to distributors of good standing. Write for information.




Circle 126 on Reader Service Card

Continued

is of hard surfaced aluminum. Valves can be operated without lubrication where the application dictates oilless operation. Valves operate on pressures from 3 to 200 psi.

Operation: Valves can be oper-

ated manually or electrically by interchanging the operating valve units. Also offered are a line of speed controls and reusable fittings and hose. The manual operating valves can be used for push-button starting or as air limit switches for automatic return of cylinder piston.

Sizes: 2½ x 2½ x 2 inches in size. Capable of delivering media from full ¼ and ⅜ inch orifices. The valves are ported with cylinder ports at 90 degrees so that valves can be mounted directly to rear or side ports of cylinders.

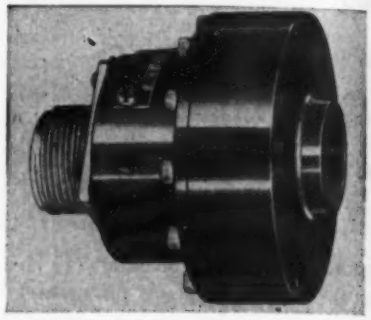
**Airelectric Corporation**
**Melrose Park, Illinois**
Circle 248 on Reader Service Card

### PRESSURE SWITCH
### . . . 10 to 200 psi range

Designation: Model 44517

Design: Of simple construction, 2- 2½ inches in diameter, this pressure switch is comprised of a pressure responsive element which actuates a switch that can be set at the factory to a predetermined pressure.

Features: The unit includes high overpressure rating and a suitability for use with engine oil or hydraulic fluid into the gauge port. Unit can be quickly dis-



connected and is set at the factory to operate at any differential pressure between 10 and 200 psi.

Applications: For control system actuation and pressure warning for shut-off devices.

**G. M. Giannini & Co., Inc.**
**Pasadena, California**
Circle 249 on Reader Service Card

### HYDRAULIC POWER UNITS
### . . . for high horsepower jobs

Designation: 32-10 Series Rotodraulic hydraulic pumps, fluid


Bruning

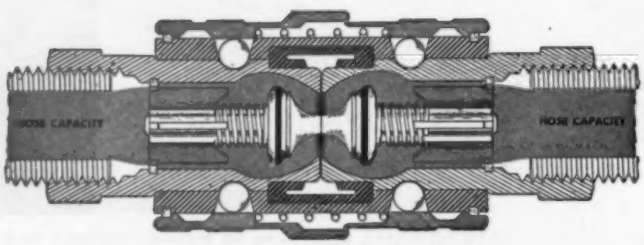
QUICK-DISCONNECT COUPLERS

**QUICK-SIMPLE-POSITIVE COUPLING AND UNCOUPLING**

There is no spurting or loss of oil either when coupling or uncoupling. No oil gets out—No dirt gets in.

**SIMPLE AND POSITIVE "AUTOMATIC BREAK-AWAY"**

Available for either single or multiple line systems. Standard or pressure couplers easily convert to "Automatic Breakaway."




**FULL FLOW, POSITIVE SEATING VALVE DESIGN**

Specially designed patented sealing system. Guaranteed not to leak either coupled or uncoupled.

**SIZES AND TYPES FOR EVERY APPLICATION**

Full capacity couplers for all line sizes from ⅜" to 1".

**EASILY COUPLED OR UNCOUPLED WITH FULL PRESSURE ON THE LINES**

No special tools, gadgets or brackets required. Easily coupled by hand to 3,000 PSI.

**SYSTEM COMPLETELY SEALED AND PROTECTED WHEN DISCONNECTED**

No oil gets out—No dirt gets in. No special caps, plugs or other gadgets needed.

THE BRUNING COMPANY
Lincoln, Nebraska




Circle 26 on Reader Service Card

motors and transmissions.
**Design:** Rotating piston design, these units may be used as either pumps or fluid motors interchangeably. In either case they are instantaneously reversible with equal performance in either direction of rotation. As pumps the displacements are 60, 120 and 180 gpm at 1,000 psi continuous, 1,500 psi intermittent. Built-in gears allow direct-connection at 1,200 rpm, 760 rpm or 472 rpm. Overhang belt or chain drives are permitted. When used as fluid motors, ratings up to 300 hp and 19,000 lb-in of torque are obtainable at 1100 rpm.
**Applications:** Earthmoving equipment, cranes, marine vessels, mining machines, sawmills, steel mills, drilling rigs etc.

**Oliver Iron & Steel Corporation**
**Berry Division**
**Pittsburgh, Pa.**

Circle 250 on Reader Service Card

### *PIPE FITTINGS*
### *. . . with Dryseal threads*

**Sizes:** Ranging from ⅛ to 2 in.
**Features:** A complete line of standard J.I.C. steel high pressure pipe fittings with Dryseal pipe threads. The pipe threads are precision machined by the "drymatic seal" threading pro-

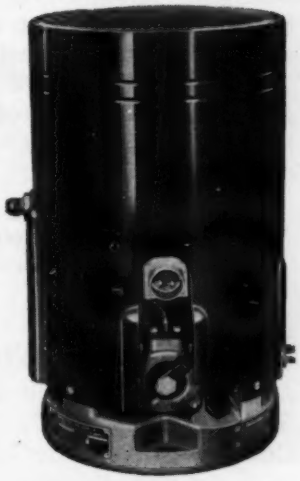
cess. This process eliminates the troublesome tapping imperfections in female pipe threads such as the appearance of wavy surface threads and tap termination steps or notches. The pipe fittings are made from bar stock and are designed to hold the same high pressures as Flodar steel tube fittings. Used in combination with tube fittings, a wide variety of unusual connections can be made.

**The Flodar Corporation**
**Cleveland, Ohio**

Circle 251 on Reader Service Card


NEWMATICS

## SELF-CONTAINED RHODES LEWIS HIGH-PRESSURE (3000 psi) COMPRESSOR SAVES SPACE, WEIGHT, MAINTENANCE



***features:*** Integral package unit, requires only simple power source and reservoir connections . . . operates 500 hours continuous duty per Specification MIL-C-7135 . . . used extensively in military aircraft pneumatic systems . . . easy to install and service . . . takes less than five minutes to install or remove entire package unit. *Approved by U. S. Navy for installation in military aircraft.*

***See Rhodes Lewis for these new light-weight products and systems***

| ITEM | Used in high-pressure pneumatic systems | Used in low-pressure pneumatic systems | Other aircraft applications |
|---|---|---|---|
| AC & DC Compressors | X | X | |
| Hydraulically Driven Compressors | X | X | |
| Bleed Turbine Compressors | X | X | |
| Fiberglass Pneumatic Receivers | X | X | |
| Electrical & Electronic Control Systems | | | X |
| AC & DC Motors | X | X | X |
| Small Accessory Turbine Drives | X | X | X |
| Pneumatic Valves, Operated Electrically or Mechanically | X | X | |
| Solenoids, Intermittent or Continuous Duty | X | X | X |
| Pneumatic Ejection Systems | X | X | |

Take advantage of Rhodes Lewis engineering knowledge and manufacturing facilities in the field of electrical and pneumatic equipment. Your inquiries are cordially invited.

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*Subsidiary of McCulloch Motors Corporation*
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ELECTRIC PNEUMATIC ENGINEERS · MANUFACTURERS

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Continued

### SPIRAL BACK-UP RINGS
**. . . shipped in new mandrel package**

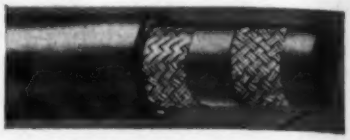
**Features:** Teflon ring supplied with bevel or scarfed cut, improved gap, and wall dimensions. The scarfed cut allows the spiral

to present an almost flat surface to the "O" ring eliminating any possibility of marking or tearing of the ring. The tightening of the gap dimension while still allowing for expansion avoids creating a point for extrusion of the "O" ring under highest pressures. The new wall dimension takes into consideration the actual ID and OD of groove and cylinder wall and permits precision fit in both external and internal applications. Mandrel packaging is a new improvement in shipping and storage methods. This insures undamaged parts, maintains ID and OD of rings for ease of installation and also allows ease of dispensing individual parts. Type, size and date packed is clearly marked on each mandrel which avoids costly rechecking of sizes.

**Reid Enterprises,**
**Los Angeles, California**
Circle 252 on Reader Service Card

### RUBBER HOSE
**. . . for air and oil circuits**

**Designation:** Vari-Purpose Hose
**Sizes:** ¼ to 1½ in ID
**Construction:** Rubber hose, built with a tough abrasion resistant cover that withstands sunlight and weather checking. Is in-



separably bonded to a specially compounded oil resistant tube and reinforced with highest quality braided rayon cord.
**Features:** Working pressures vary from 125 psi in the 1½ in ID to 300 psi in the smaller ID's. Available in either 1, 2, or 3 braid constructions. Any desired length or in 500 ft bale quantities.

**Hamilton Rubber Mfg. Corp.**
**Trenton, New Jersey**
Circle 253 on Reader Service Card

### DETECTOR
**. . . for air-flow and liquid-level**

**Designation:** Detect-A-Flo
**Operation:** Based on the principle that the amount of heat conducted away from a constant heat source varies with the rate of flow of air moving past that


REDUCE HYDRAULIC MACHINE MAINTENANCE AND "DOWN-TIME" UP TO 90%

**. . . and you can prove it in your own plant without immediate cash outlay or purchase.**

We are willing to prove that this filter will improve precision and production up to 90%. We will send, on memo, the installation of your choice. See pumps, valves and spindles take on new life with a

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Without cost or obligation send me:
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_____Installation for up to 15 gal. capacity
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Name _____ Title _____
Company _____
Address _____

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**NOW! *a dependable source* for SMALL BORE *SPECIAL* CYLINDERS**

All Mounting Styles . . . For AIR-OIL-WATER-VACUUM SERVICE

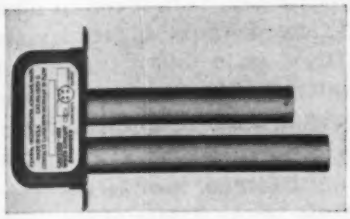
After years of building the AIROYAL line of standard small bore cylinders we are now filling the demand for special small bore cylinders in sizes from ¼" to 2½" bore. Send us your specifications. Ask for Bulletin 300 on standard cylinders.

*We feature cylinders for severe production service and for extreme pressures.*

**COMPRESSED AIR PRODUCTS**
**MAPLEWOOD, NEW JERSEY**
**Representatives in Principal Trading Areas**

Circle 41 on Reader Service Card

surface. One leg of the unit is continuously heated by a small internal heater. As the flow rate drops, the heated leg expands because less heat is conducted away. The resulting expansion is transmitted through lever action to a strut-and-electrical-contact assembly in the other leg. This motion relaxes the tension in the struts and causes the contacts to move apart, thus breaking the circuit.



**Features:** Highly accurate, responds to a change of less than 0.1 in. in liquid level. Can be set to respond to any mass rate of flow of air in the approximate range of 1000 to 50,000 lb per hr per sq ft. It is inserted directly in the duct line or tank being monitored, thus eliminating lead lines, auxiliary fittings, and related condensate or clogging problems.

**Specifications:** Operating temperature range —65 F to 175 F. Operating sensitivity at room temperature is less than 0.25 ft. per sec. at low flows and less than 1 ft per sec at the higher flows. Maximum dimensions of the unit are approximately 2 by 2¼ by 5¼ in; weight is approximately 8 oz. The heater draws 35 watts at 28 volts AC or DC; a 115 volt model will also be available. The control can handle 5 amp at 115 volts AC or 2 amp at 28 volts DC.

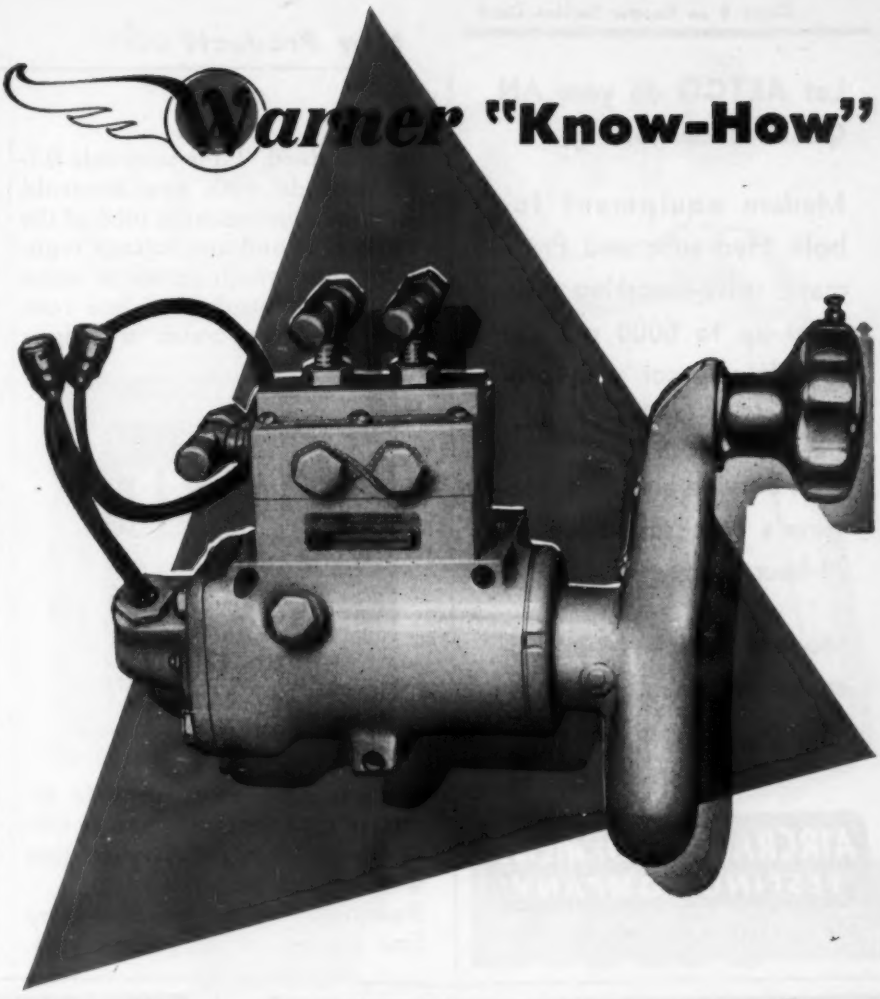
**Fenwal Incorporated**
**Ashland, Mass.**
Circle 254 on Reader Service Card

### *INTERVAL TIMER*
***. . . uses electronic circuit***

**Designation:** Type 60 MC

**Operation:** Electronic timer operates to provide a contact closure adjustable in duration. Designed so that the interval may be initiated by a foot switch, push button, pressure switch or other contact closing device. This contact may be momentary


Warner "Know-How"



**The "Know-How" to Mass Produce Precision Hydraulic Equipment**

The hand pump shown above is a typical example of Warner's ability to mass produce precision hydraulic equipment. This pump is used in connection with a special ordnance application requiring high volumetric efficiencies and must be produced to very close tolerances.

Warner is qualified by experience and facilities for the design and production of hydraulic equipment for a wide range of uses.

Warner engineers will welcome an opportunity to assist you in the development of special hydraulic equipment to meet your particular requirements.

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Modern equipment for both Hydraulic and Pneumatic units—working pressures up to 5000 psi. Let us help you set your production schedules ahead.

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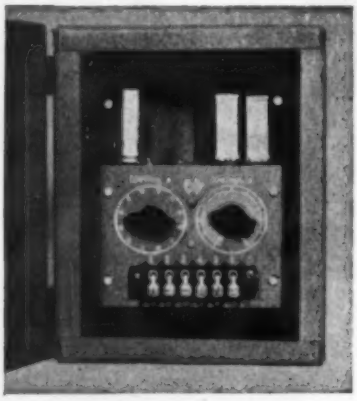
## New Products

Continued

or sustained. Time intervals 0.1-60 seconds with two controls. Employs one vacuum tube of the radio type and one voltage regulator tube which serves to make timing independent of line voltage. It incorporates a unique



electronic circuit to provide accurate time intervals and operation from a momentary contact without auxiliary relays.

**Features:** Timing unaffected by line voltage or frequency variations; operation from momentary or sustained contact without an auxiliary relay.

**Specifications:** Power supply, 105-125 volts, 50-60-cycles, 6-8 watts; relay, single pole-double throw wired normally open, 10 ampere contacts; controls, operates from momentary contact.

**Application:** Wherever an interval timer is required; it may also be used as a delay timer. It is primarily intended for use in industrial control applications.

**G. C. Wilson & Co.**
**Chatham, New Jersey**
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### PRESSURE PICK-UP
### . . . for high temperature use

**Specifications:** Field tests indicate that the stainless steel diaphragm of the new pick-up can be exposed to gas temperatures in excess of 5000 F without damage. The heat transfer rate for the entire face of the unit is 11

NICHOLSON AIR-GAS-STEAM TRAPS

NEVER NEED PRIME

Nicholson weight-operated traps, under no condition, leak pressure medium. This prevents the costly loss of air, gas or steam occurring when inverted bucket traps lose their prime. Nicholson traps hold tight because they have a positive water seal and do not depend on buoyancy of float to raise valve. Other features: exclusive new oil-eliminator; special hardened stainless steel valve. 3 types; pressures to 200, 500 and 1500 lbs. Send for...

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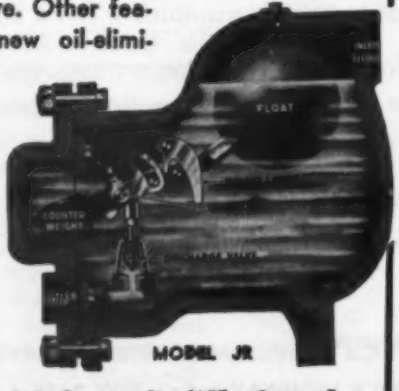


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MONOPAK METALLIC PACKING

Prolongs the Life of Hydraulic Cylinders

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ASSURES UNEXCELLED DURABILITY
Burst-proof, does not blow out . . . Compact and easy to install . . . Low Friction insures long life. Now adopted by hundreds of manufacturers and users of machine tools.

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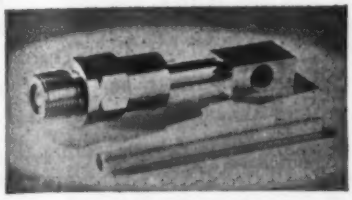
btu per sq in per second with a cooling water temperature rise of 85 F. Since all exposed parts are made of stainless steel, the pick-up can be safely exposed to highly oxidizing conditions.

**Applications:** The water-cooled



pressure pick-up will help solve problems of obtaining reliable pressure measurements in high temperature systems. It is expected to be particularly useful in current research activities on rocket propellants and jet engines.

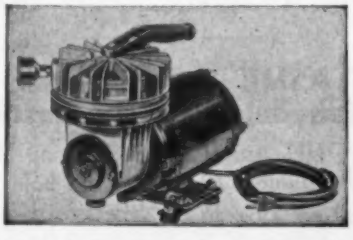
**Control Engineering Corporation**
**Norwood, Mass.**
Circle 256 on Reader Service Card

### *AIR COMPRESSOR*
### *. . . has 3½ cfm capacity*

**Designation:** Series J Air Compressor

**Size:** Weighs 40 lbs, motor is ⅓ hp, 115/230 volt, with overload protection switch and capacitor.

**Features:** This small compact air compressor does not require a tank and provides continuous volume up to 3½ cu ft per min-



ute and a maximum operating pressure of 100 psi. Air devices may now be individually furnished with pressure at a production station, jig, or outdoor location without the necessity of running expensive piping from plant stationary air supply, within the capacity rating of this compressor. There is no pop-off valve nor lubrication required. Continuous running during the air equipment operation is compensated for.

**Modernair Corporation**
**San Leandro, California**
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EAGLE'S MICROFLEX COUNTER means

"AUTOMATIC ACCURACY"

If your application requires "batching" of liquids, the Eagle Microflex counter will accurately count the batches for greater efficiency and increased profit.

For automatic control of materials by time or count, send your application problem to Eagle's experienced engineers. Eagle has suggested answers and speeded up operations in many plants from coast to coast.

TELL US YOUR PROBLEMS — WE'LL DO THE REST

EAGLE TIMERS WILL MAKE YOUR MACHINES AUTOMATIC

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# Fall Technical Meetings

## National Metal Congress and Exposition

THE 35th National Metal Congress and Exposition will meet the week of October 17-23 at Public Auditorium, Ceveland. The Exposition will be open from Monday through Friday, October 19-23; various meetings of the National Metal Congress will be held from Saturday, the 17th, through the following Friday, the 23rd. W. H. Eisenman, National Secretary of the American Society for Metals and Managing Director of the Congress and Exposition, states that upwards of 50,000 registered visitors are expected to attend.

Over 400 nationally known firms engaged in the production of metals, the treatment of metals, the fabrication of metals into component parts or products or in rendering services to any or all of these, have reserved a total of 210,000 square feet of exhibit floor space—nearly five acres. In addition thousands of square feet of space has been set aside for special meetings, forums, lectures and other activities connected with the Congress and the Exposition.

The National Metal Congress and Exposition is sponsored by the American Society for Metals, American Welding Society, Institute of Metals Division, American Institute of Mining and Metallurgical Engineers and Society for Non-Destructive Testing. Each of the Societies will hold technical sessions.

The theme of the 1953 show, "Metals Market Place of the World" will be carried through a number of papers and individual exhibits.

## Machine Tool Electrical Group to Meet

THE sixth annual Conference on Machine Tools sponsored by the Sub-Committee on Machine Tools of the American Institute of Electrical Engineers will be held at the Cleveland Hotel, Cleveland, Ohio on October 14, 15 and 16. An attendance of approximately 500 is expected, composed largely of electrical and mechanical engineers of the Machine Tool Builders, Electrical Manufacturers and large users of machine tools, such as the automotive and the aircraft industries.

A series of eleven technical papers will be presented; the program will provide up-to-date information on new products, processes and techniques. Ample opportunity will be provided for the discussion of applications and mutual problems in connection with various Standards, Codes and safety regulations applicable to the designing, building and use of electrified machines.

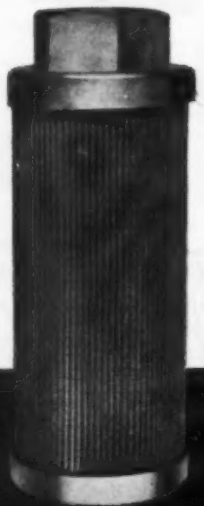
Frederick S. Blackall, Jr., President of Taft-Pierce Manufacturing Company and President of the American Society of Mechanical Engineers, will address the banquet on October 14 on the subject, "The Engineer's Obligation to a Free Society."

R. H. Clark, Administrative Engineer, Warner & Swasey Company, Cleveland, is General Chairman; Kurt Tech, Chief Engineer of the Cross Company, Detroit, is Vice Chairman and V. R. Murphy, Application Engineer, Reliance Electric & Engineering Company, Cleveland, is Program Chairman.

## ASME Fall Meeting Scheduled for Rochester

THE American Society of Mechanical Engineers will hold its fall meeting in the Sheraton Hotel, Rochester, N. Y., October 5 through 7, with the cooperation of the Rochester Engineering Society and the Engineering Institute of Canada.

Technical sessions on Monday, the 5th, will cover machine design, production engineering, process industries and materials handling. On Tuesday sessions will cover fuels and heat transfer in addition to machine design, metal processing and production engineering. On Wednesday fuels, safety, management, power, education, instruments and regulators will be discussed. Frederick S. Blackall, Jr., ASME president has chosen for his presi-

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CAPITAL HYDRAULIC OIL FILTER
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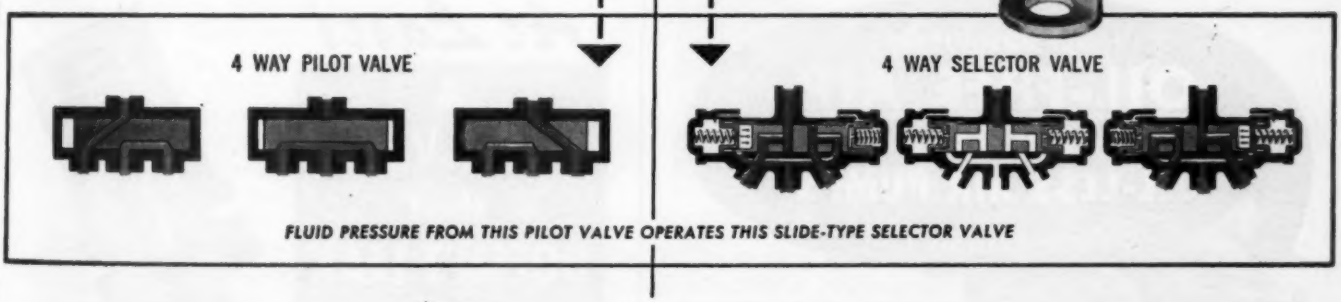


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General Controls AV-14 Series electrohydraulic selector valves guarantee positive control of high-pressure and high flow hydraulic systems. The pilot valve, balanced by opposing continuous duty solenoids, positions the selector valve by directing fluid to one end of the slide and returning it at the other. This double balance permits maximum efficient control with minimum current drain. Compact and light weight, with specially hardened and optically ground sealing surfaces that approach "zero" leakage. General Controls Hi-g selector valves provide leakproof control of all fluids at pressures ranging from 150 to 3000 psi. For complete information on the AV-14 Series, the AV-16 Gate Valve Series and Hi-g Limit Controls, send for your copy of Catalog 53A today.

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dential address the subject, "ASME Standards Save Lives and Dollars." Plant tours to leading manufacturing and processing plants in the Rochester area have been arranged.

The annual Calvin W. Rice Lecture will be given by J. Foster Petree, editor of "Engineering", London, on "The Position of the Technical Press in Relation to Industry." Carey H. Brown, Manager of Engineering and Manufacturing Services, Kodak Works, Eastman Kodak Company, will deliver the Roy V. Wright Lecture on "Engineering Manpower."

# Program of the N.F.P.A. Meeting

THE first regular semi-annual meeting of the National Fluid Power Association will be held on Tuesday and Wednesday, October 6 and 7, at the Hotel Sheraton, Chicago. The general chairman, John C. Hanna, vice president and chief engineer, Hanna Engineering Works, announces that the meeting will be an open one and that representatives of manufacturers of hydraulic and pneumatic components and equipment will be welcome to sit in on any of the sessions.

Because the meetings will be held the two days immediately prior to the sessions of the National Conference on Industrial Hydraulics, which will be held in the Hotel Sheraton also, a very considerable group is expected to attend. General, product and special subject sessions are listed; sessions are arranged so that registrants may attend meetings of special interest to them.

Details as to qualifications for membership in N.F.P.A. will be available to non-members at the meeting. Organized only last May, the Association already has over 40 company memberships in the fluid power field.

**PROGRAM**

TUESDAY, OCTOBER 6

8:30 A.M. Registration, Hotel Sheraton

10:00 A.M. GENERAL SESSION

Chairman: John C. Hanna, Vice President and Chief Engineer, Hanna Engineering Works, Chicago, Ill.

"Purposes and Objectives of the NFPA"

General Remarks: J. E. Erskine, Vice President, Racine Hydraulics & Machinery, Inc., Racine, Wis.

Engineering Standards: J. J. Pippinger, Vice President, Double A Products Company, Manchester, Mich.

Education: Ellwood G. Peterson, President, Hannifin Corporation, Chicago, Ill.

Government Relations: L. A. Shea, Manager, Hydraulic Division, Lindberg Engineering Company, Chicago, Ill.

12:15 P.M. LUNCHEON SESSION

Speaker: Tell Berna, General Manager, National Machine Tool Builders Association

2:15 P.M. PRODUCT SECTIONS SESSIONS

Concurrent round table discussion by each product section (pumps, valves, cylinders, etc.) on a variety of subjects of in-


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OIL-FREE AIR
with GAST rotary
OIL-LESS AIR PUMPS

Below — Oil-less 3040, end plate removed. From 17 to 24 C.F.M.

Oil-less Model 1550 — 8 to 10.5 C.F.M.

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THEY RUN ENTIRELY *without oil* in pumping chamber. Carbon rotor vanes lubricate themselves — through thousands of hours' use. Ball bearings grease-sealed for life. You can forget oiling problems!

DELIVERS ABSOLUTELY OIL-FREE AIR. Your product or material can't be contaminated with oil droplets.

FOR BOTH VACUUM AND PRESSURE, Gast Oil-less Models are precision-built for dependable high performance. Sizes from 3.5 to 24 C.F.M., 3 to 10 lbs. pressure, 10 to 20 in. vacuum.

*Original Equipment Manufacturers for Over 25 Years*

GAST ROTARY AIR MOTORS · COMPRESSORS · VACUUM PUMPS
(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)
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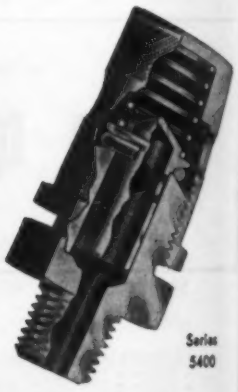
A
Relief Valve
*that*
DOESN'T LEAK
*for pressures from .75 to 100 psi*



Series 5400

***Features:*** An extremely precise, adjustable, low-pressure pop-off relief valve providing "dead-tight" sealing up to the cracking pressure—quick reseat with zero leakage. Available in five pressure ranges.

***Design:*** Incorporates "Circle-Seal" principle employing a standard, resilient "O" ring self-aligning between conical seats of a poppet type valve. Standard "O" ring is used for very low pressures. For higher pressures the "O" ring is supplied with a metal "back-up" ring.

***Construction:*** Aluminum or brass in standard design; stainless steel to order. Connection sizes ⅛" or ¼" male pipe, standard; $\frac{7}{16}$"-20 or $\frac{9}{16}$"-18 straight thread, to order.

***Service:*** For controlling gases safe to release into the atmosphere in systems where leakage cannot be tolerated or is undesirable for reasons of economy. Temperature range: −40°F to 280°F, standard; −80°F to 400°F, to order.

*Another* CIRCLE SEAL *precision valve*

*Engineering Data Free on Request*

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terest to members and pertinent to trade association activities, such as marketing, warranties, ratings, nomenclature, engineering methods and the like.

Pump Section—Chairman: J. E. Erskine, Vice President, Racine Hydraulics & Machinery, Inc., Racine, Wis.

Valve Section—Chairman: J. J. Pippinger, Vice President, Double A Products Company, Manchester, Mich.

Cylinder Session—Chairman: L. R. Burger, Sales Manager, Logansport Machine Co. Inc., Logansport, Ind.

WEDNESDAY, OCTOBER 7

9:30 A.M. GENERAL SESSION

Chairman: B. N. Ashton, President, Electrol Incorporated, Kingston, N. Y.

(1) "Education" Short talks on:
- (a) In-Industry Training
- (b) Service and Maintenance Training
- (c) Professional Training

(2) "Government Relations and the Trade Association"

12:15 P.M. LUNCHEON SESSION

(speaker to be announced later)

2:00 P.M. ENGINEERING STANDARDS SESSION

Chairman: J. E. Erskine, Vice President, Racine Hydraulics & Machinery, Inc., Racine, Wis.

To acquaint all component manufacturers with the recommendations of each product section, subsequently breaking up into product groups for round table discussions.

2:30 P.M. GOVERNMENT RELATIONS SESSIONS

Chairman: J. G. Jones, Vice President & General Manager, A. W. Cash Company, Decatur, Ill.

A round table discussion on the needs of the industry

2:30 P.M. EDUCATION SESSION

Chairman: F. X. Cascone, Hydraulics & Pneumatics Div. James L. Entwhistle Company, Providence, R. I.

A round table discussion on the needs of the industry

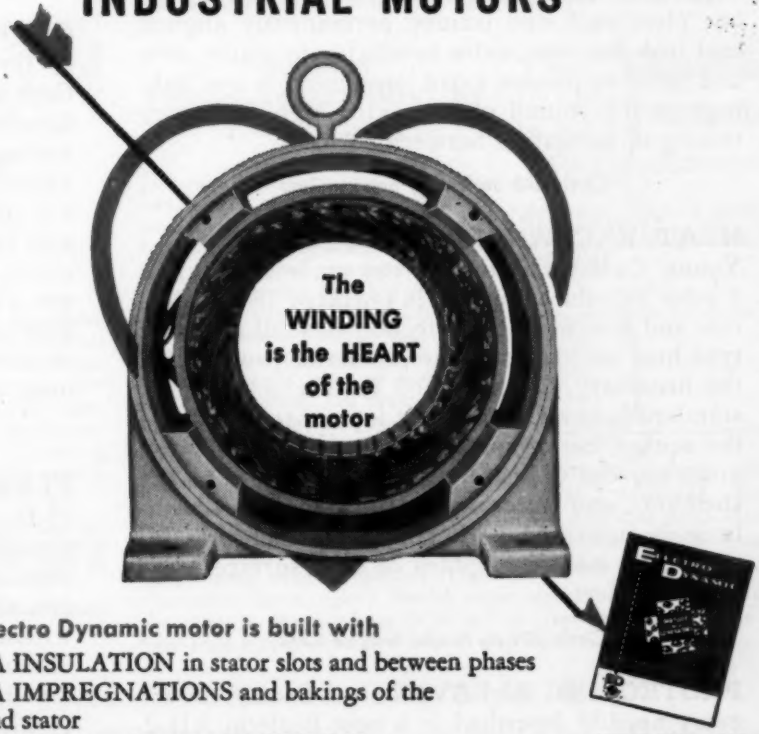
4:00 P.M. GENERAL SESSION

Reports from various sections, committees and activities. Announcement of committee appointments and future plans.

Adjournment.


ELECTRO *xtra* DYNAMIC *ependable*

INDUSTRIAL MOTORS

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EXTRA INSULATION in stator slots and between phases
EXTRA IMPREGNATIONS and bakings of the wound stator
EXTRA HIGH-FREQUENCY TESTING of insulation between turns

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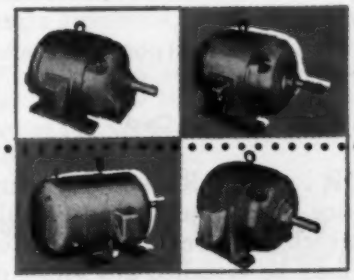


One-piece cast iron frames.

Extra large "free-flo" air channels.

Permanently aligned cast iron brackets.

Liberal size grease lubricated bearings.

*Also a complete line of Direct Current motors and generators*

ELECTRO DYNAMIC
DIVISION OF GENERAL DYNAMICS CORPORATION
BAYONNE, NEW JERSEY

# USEFUL LITERATURE

**You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation**

Continued from page 44

**INDUSTRIAL MOTORS** . . . "Running Under Water for over 50 Years" and "Up from the Sea Comes Fabulous Motor Stamina for Industry" are pieces of literature released by Electro-Dynamic of General Dynamics Corp. Drip-proof, splash-proof, totally enclosed fan cooled and totally enclosed non-ventilated motors are types illustrated. These range up to 60 hp. Features are one piece cast iron frames, permanently aligned cast iron brackets, extra insulation in stator slots and between phases, extra impregnation and bakings of the wound stator, extra high frequency testing of insulation between turns.

Circle 208 on Reader Service Card

**HEAT EXCHANGER CALCULATOR** . . . Young Radiator Company has made available a 2 color calculator, which is operated like a slide rule and is used in the selection of shell-and-tube type heat exchangers. The calculator provides all the necessary data required for the selection of standard heat exchangers. It is used to determine the square feet of surface necessary to transfer a given amount of heat between oil or water on the shell side, and water on the tube side. The calculator is furnished with simplified operating instructions including tables of tube surface areas in square feet.

Circle 209 on Reader Service Card

**PROTECTIVE SLEEVES** . . . Protection for every need is described in a new Bulletin AH-2, just issued by A & A Manufacturing Company. Sleeves and boots, molded of a neoprene-base material in a wide range of stock-ring sizes are available. Tables give maximum and minimum lengths and a wide range of ID x OD sleeve sizes. Telescopic sleeves for special purposes are also available.

Circle 210 on Reader Service Card

**AIR LUBRICATOR** . . . The Rucker Company has released literature on a patented adjustable feeder lubricator which supplies oiled air for pneumatic tools. It may be installed anywhere in the air line, positioned so the compressed air will follow the flow. Lubrication is immediately effective. Once in the air line with pressure turned on, the pressure backs up into the feeder, and by means of the breather, into the oil reservoir where pressure is equalized. When the operator starts the tool the pressure momentarily drops. Back pressure in the reservoir forces a fog of oil into the air line. This fog of oil, suspended in the line, provides lubrication. Specifications of sizes available and cross-section view of lubricator are included.

Circle 211 on Reader Service Card

**OIL FILTERS** . . . Catalog 106 has been released by the Marvel Engineering Company, describing their sump and line type Synclinal filters for hydraulic oils, coolants and lubricants. The advantages of the Synclinal design are listed. Dimensional and engineering data on the standard 100 mesh, monel filter element, both in sump and line types in sizes from 5 to 100 gpm are given. Other mesh sizes, both larger and smaller, are available. Parts lists, a table of theoretical flow and pressure drop, and ASTM standard viscosity temperature charts, add to the usefulness of the catalog.

Circle 212 on Reader Service Card

**FLEXIBLE METAL HOSE** . . . Bulletin No. 15-D, issued by the Atlantic Metal Hose Co., Inc., describes their line of four-wall interlocking metal hose. Features claimed for the high pressure hose are, they cannot kink, deteriorate or burst, will withstand friction and abrasion, absolutely tight, eliminates bends and joints and is easy to handle. The high pressure hose is furnished as standard (without jacket) with bronze or steel braided wire jacket or for both high pressure and high temperature with a spiral wire armor.

Circle 213 on Reader Service Card

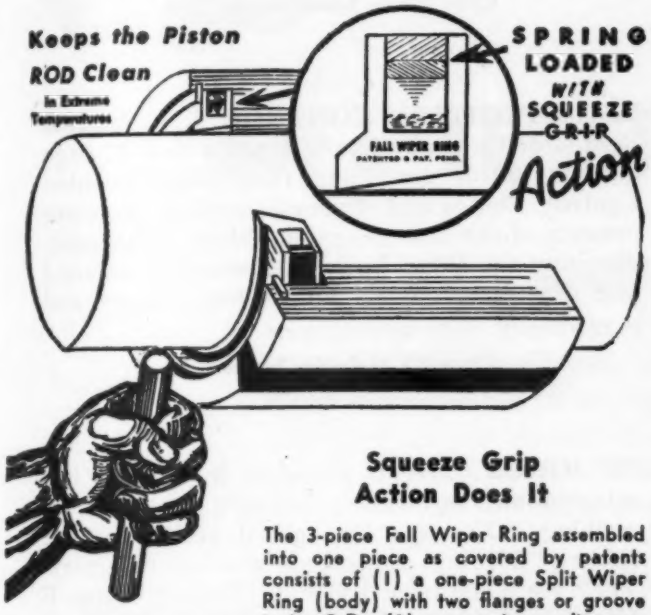
**HYDRAULIC OILS** . . . A booklet No. 1300-S has been released by Vickers Inc.—"Hydraulics for Industrial Machinery", with sections on types and performance characteristics of hydraulic oils and the operation and maintenance of hydraulic components. Oil viscosity recommendations for industrial hydraulic systems using Vickers pumps and control valves are given. Operating and maintenance precautions with emphasis on good oil care, are given. Suggestions on oil changes, cleaning and flushing the system and the use of oil filters and air cleaners are very practical. A maintenance check list and a trouble shooting chart add to the usefulness of the bulletin.

Circle 214 on Reader Service Card

# The Fall Wiper Ring

# Keeps The Piston Rod Clean!

**Since 1944—Spring-Loaded with "Squeeze Grip Action" and (dry) Lapped True Circle**




Used During World War II and ever since by the Military

Fall Wiper Rings Spec. MIL-S-5049 are AN Approved.

## Squeeze Grip Action Does It

The 3-piece Fall Wiper Ring assembled into one piece as covered by patents consists of (1) a one-piece Split Wiper Ring (body) with two flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in the groove (3) an endless cover band surrounding the spring in the groove which causes a squeeze grip action on the piston rod.

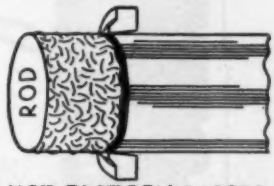
**The Fall Wiper Ring is available from ½" to 13" dia. Military part numbers from AN6231A1 to AN6231A71. Write, wire or phone us regarding your wiper needs.**

## Exclusive Spring-Loaded "Squeeze Grip Action"—

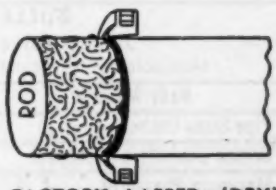
1. Eliminates spotty or erratic contact on rod.
2. Provides longer life because the spring in the "Squeeze Grip" takes up all wear, while the light-tight wiping edge continues to grip the rod.
3. The Spring Loaded "Squeeze Grip" Action on the rod is exactly the same for any number of rings of a given size because the pounds of **breakout friction** is individually controlled in each ring.

## Exclusive Factory Lapped (dry) by Pre-Actuating

In addition to complying with Spec. MIL-S-5049, we create a **worn-in** true circle contact on piston by carefully pre-actuating each ring. This is done to avoid a wearing-in period after the ring has been installed . . . a period during which the ring might not completely contact the piston with the possibility that small metal fragments would wear off and enter the packing gland. This pre-actuating process is used by us exclusively and insures **immediate true circle contact,** from moment of installation. Only when the Spring Loaded "Squeeze Grip" action and Factory Lapped (dry) features are combined can full wiper contact and a light-tight wiping edge be assured. (See Illustration above, right.) This full wiper contact is long-lived because the spring in the "Squeeze Grip" action takes up the wear while the light-tight wiping edge continues to grip the rod.

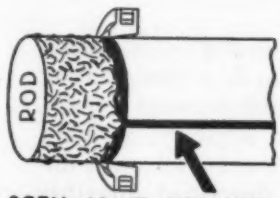



NOT FACTORY LAPPED (DRY) - LEAVES DIRT ON ROD

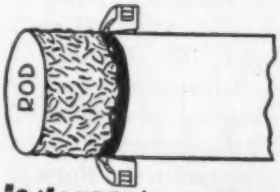



FACTORY LAPPED (DRY) WITH "SQUEEZE GRIP" ACTION ON ROD—STOPS PASSAGE OF DIRT (except at Joint)

## The FALL "CJ" Closed Joint Wiper Ring




OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING




"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

Another First for FALL Wiper Rings! The FALL "CJ" Closed Joint Ring has been especially designed for those applications requiring absolute freedom from dirt passing through joint of ring to bearings or packing. (See illustations at left.) This FALL Closed Joint ring has the same Spring Loaded "Squeeze Grip" Action and Factory Lapped (dry) wiping edge as our regular 3-piece "3C" type ring and functions exactly the same BUT with the added assurance that NO dirt passes through the joint. Patented and other patents pending.

FALL "3C" three-piece Wiper Rings are available in all sizes to including 13" diameter. FALL "CJ" Closed Joint Wiper Rings are available in certain sizes now, other sizes soon. Our engineering staff will gladly work with you in solving your wiper ring problems. Write, wire or phone us.


**Ace Products Company**

**P.O. Box 784** **Toledo 1, Ohio** **Phone ADams 6513**


***All Fall Wiper Rings are covered by patents issued and patents pending.***

**Fall Wiper Ring** SPRING LOADED

**ADDED FEATURE in Midget 2 & 3 Way Solenoid Valves**

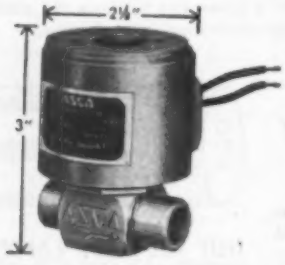
ASCO

**Explosion-Proof**

protection for

Personnel, Production & Plant

ASCO Midget Valves are now available with explosion-proof housings, designed in accordance with Underwriters' recommendations for use in Class 1, Group D hazardous locations. These Bulletins 8262 & 8314 ASCO Valves with the Explosion-Proof Solenoid Enclosure (they're also water tight) may be just what you need. Classed as "small" valves, they are doing a big job in the automatic and remote control of air, gas, water, light oils, refrigeration and other fluids.




Bulletin 8262 Two-Way ASCO Solenoid Valves (Illustrated) can be obtained with by-pass and metering devices. Valves can be installed in any position. Bulletin 8314 Three-Way Valves can be applied to any 3-way valving requirement regardless of flow directions or pressure application points; no change of springs or other adjustments are necessary. These valves can also be mounted in any position and will give positive tight shut-off.

**BULLETIN 8262**

**2-Way Valve (Normally Closed)****

(Available for all commercial and industrial voltages)

| Body Material | | Brass or Stainless Steel | | | |
|---|---|---|---|---|---|
| Pipe Sizes (inches) | | 1/8 | | 1/4 | |
| Orifice Diameters (inches) | | 1/16 | 1/8 | 5/32 | 3/16 |
| Maximum Pressures lbs./sq. in. | A-C | 300* | 130 | 90 | 60 |
| | D-C | 250 | 70 | 50 | 30 |

*Available 1000 psi in stainless steel; 500 psi in brass.
**Also available normally opened.

**BULLETIN 8314**

**3-Way Valve**

(Available for all commercial and industrial voltages)

| Body Material | | Brass or Stainless Steel | |
|---|---|---|---|
| Pipe Size (inches) | | 1/8 | |
| Orifice Diameters (inches) | | 3/64 | 3/32 |
| Maximum Pressures lbs./sq. in. | A-C | 125 | 45* |
| | D-C | 50 | 25* |

*Pressures slightly lower for liquids.

Since 1888 ASCO Engineers have specialized in the constantly expanding field of Electromagnetic Controls. They have pioneered many new developments and have revolutionized many of the older concepts of automatic controls. Industry looks upon ASCO as one of the leaders in Electromagnetic Controls. Why not let our engineers help you with your problem whether it involves control on a machine of any kind you are designing or control of liquid or gas in your plant?

We also manufacture other types of Electromagnetic Controls including Automatic Transfer Switches, Remote Control Switches, Contactors, Relays and complete Control Panels.

**Write for free pamphlet "Small Solenoid Valves."**

ASCO VALVES

**Automatic Switch Co.**

385-H LAKESIDE AVENUE • ORANGE, NEW JERSEY


## USEFUL LITERATURE

**RESEARCH SERVICE** . . . Commonwealth Engineering Company of Ohio has released a 12 page booklet, "Ideas Into Dollars". The company offers a research service from the idea, to the pilot plant or model, to final production in a complete plant. Its service includes hydraulics, pneumatics, mechanics, electricity, electronics, chemical, bacteriological, or a combination of them. A company organization chart is given and the general work procedure is outlined.

Circle 215 on Reader Service Card

**EDGE POSITION CONTROL** . . . Askania Regulator Company has released a new 12 page bulletin #161, describing their Edge Position Control. Photos and diagrams explain the components of the control system. Shows schematically how the Edge Position Control is installed and illustrates models for medium, heavy and extra-heavy duty applications.

Circle 216 on Reader Service Card

**"O" RINGS** . . . W. S. Shamban & Company has released an Engineering Bulletin No. 1013, describing "O" rings for special sealing, where rubber "O" ring compounds are unsatisfactory. They are made from Kelon-T (Teflon), Kelon-F (Kel-F), Kelon-Y (Nylon) and Kelon-E (Polyethylene). Heat resistance, chemical inertness, low coefficient of friction are characteristics of this material. They are unaffected by oils, acids, bases or solvents. Applications are suggested including hydraulic, pump, valve and aircraft.

Circle 217 on Reader Service Card

**ROTARY PUMPS** . . . A pump engineering manual released by Pioneer Pump & Manufacturing Co., describes the coolant and lubricant pump, made by this company. The Rollway, a rotary mechanical pump and the Pioneer, an open impeller type pump are fully described, together with ratings, performance and various applications of each. All performances shown on capacity charts are based on actual tests. Rollway pump ratings are based on handling lubricating oil at a viscosity equal to No. 10 S.A.E. The Rollway Pump is a slow speed, positive displacement unit, built primarily to handle liquids which have lubricating properties. It is built in various models for capacities from 1 to 40 gpm. The pump develops a high vacuum and may be set considerably above the surface of the liquid being pumped without danger or loss of prime. Complete installation dimensions are given along with suggested mountings.

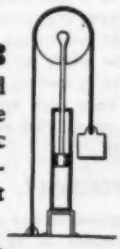
Circle 218 on Reader Service Card

# got a TENSION LINKAGE problem?

If you design hoists, lift trucks, counterweight suspensions, controls or any type of equipment where you must transmit pull or lift something, Baldwin-Rex® Roller Chain, Leaf Chain or Block Chain is likely to be the answer to your linkage problem.

## here's a good example:

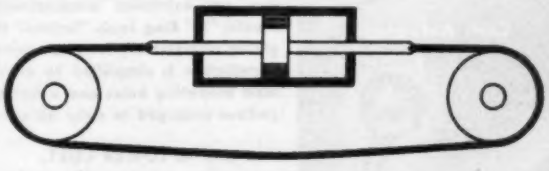
**Increase of travel distance on a hydraulic lift.** The chain, fixed at one end, passes over the sprocket, and is attached to the lift platform. The sprocket shaft is carried on the hydraulic plunger rod. In the arrangement illustrated, vertical movement of the platform is twice that of the plunger. Movement



is frequent and shock loads are severe, so *chain* is the answer. If the lift is mounted on a truck, severe shock and fatigue stresses are imposed on the chain as the truck moves.

## here's another one:

**Transmission from a double-acting hydraulic cylinder to a shaft.** Since motion must be transmitted in two directions, an idler sprocket is required as shown in the illustration. Since operation may be practically continuous, and shock effects are probable, *chain* is the answer. When this type of installation is applied to rudder control, shock and fatigue considerations are especially important.



## our Tension Linkage bulletin

Covers typical examples of tension linkage applications . . . helpful step-by-step data on equipment selection and examples to guide you in making your selections. There are tables of dimensional data and other important facts you'll find useful in your work. Send for your free copy today. Just fill in and mail the coupon below. There is no obligation.

BALDWIN-REX
ROLLER CHAINS

A PRODUCT OF
Chain Belt COMPANY
OF MILWAUKEE

BALDWIN-DUCKWORTH 52-402
Division of Chain Belt Company
399 Plainfield Street
Springfield 2, Mass.

Send me my copy of Bulletin No. 51-10 covering Tension Linkages.

*Name*.....

*Company*..... *Dept*.....

*Address*.....

*City*..... *State*.....

# control problems ??

## VERSA VALVES will solve them...

Pedal type, four-way shown. Treadle type for full foot support also available.

Foot Actuated

Pilot Actuated

Cam Actuated

Hand Actuated

**... in ANY application.**

From over 1000 standard combinations there is a type and size to suit every compressed air and low pressure water-, or oil-hydraulic valve need. Hand, foot, cam, air or hydraulic pilot actuation for two-, three-, or four-way types in ⅛, ¼, ⅜ and ½ NPT sizes.

**... in a MODERN way.**

For appearance and compactness VERSA VALVES are absolutely unequaled. Functionally designed to do a job, they have no dangerous, dirt-storing projections. For comparison, the height in all sizes is less than 2 inches, and the width for ⅛ and ¼ sizes is 2 inches; for ⅜ and ½ sizes is 2¾ inches. Lengths vary with type but they all require less space AND you get honest PIPE SIZE FLOW.

**... EASILY and DEPENDABLY.**

VERSA VALVES are engineered and quality produced to give millions of cycles of trouble-free performance. VERSA'S exclusive anti-extrusion arrangement of all kinetic "O" Ring Seals "babies" them into giving impressively long, air-tight service. Installation is simplified by easily accessible mounting holes and a flat mounting surface arranged to clear all connections.

**... and at LOWER COST.**

First cost is lower. Also, maintenance cost is lower because one spool assembly is the only moving valve part. This assures you of long-time, attention-free performance. When service is required, any VERSA VALVE can be completely disassembled with an ordinary screw driver without disturbing pressure line connections.

SEND FOR YOUR FREE CATALOG

A few territories are open for distributors.

# VERSA

PRODUCTS COMPANY, INCORPORATED

249 SCHOLES STREET BROOKLYN, NEW YORK


## USEFUL LITERATURE

**COMBINATION MOTOR STARTERS** . . . A new bulletin, Number 514 & 515, has been issued by the Industrial Controls Division of Federal Electric Products Company. Various types of combination motor starters are illustrated and described, including detail drawings of special features. Specifications and dimensions of the enclosure types are included.

Circle 219 on Reader Service Card

**INDUSTRIAL AIR HOSE** . . . A new bulletin issued by Quaker Rubber Corporation, Division of H. K. Porter Company, Inc. describes seven of this company's complete line of industrial and general purpose air hoses. Full specifications and service recommendations for each type are given. The uses vary from heavy-duty construction through digging and drilling operations to many heavy and light industrial and commercial uses for air hose. Size charts showing working pressures and weights for various diameters are given. Also covered in the bulletin are the types of couplings best suited for the specific hose.

Circle 220 on Reader Service Card

**POWER TRANSMISSION SERVICES** . . . Four services—job analysis, components, engineering and design, manufacture and installation are offered by The Rucker Company, specialists in hydraulic and pneumatic power systems. These services are described and illustrated in a new four page bulletin. A brief history of the Rucker organization and a brief review of the engineering, design and special manufacturing services they are equipped to render are covered.

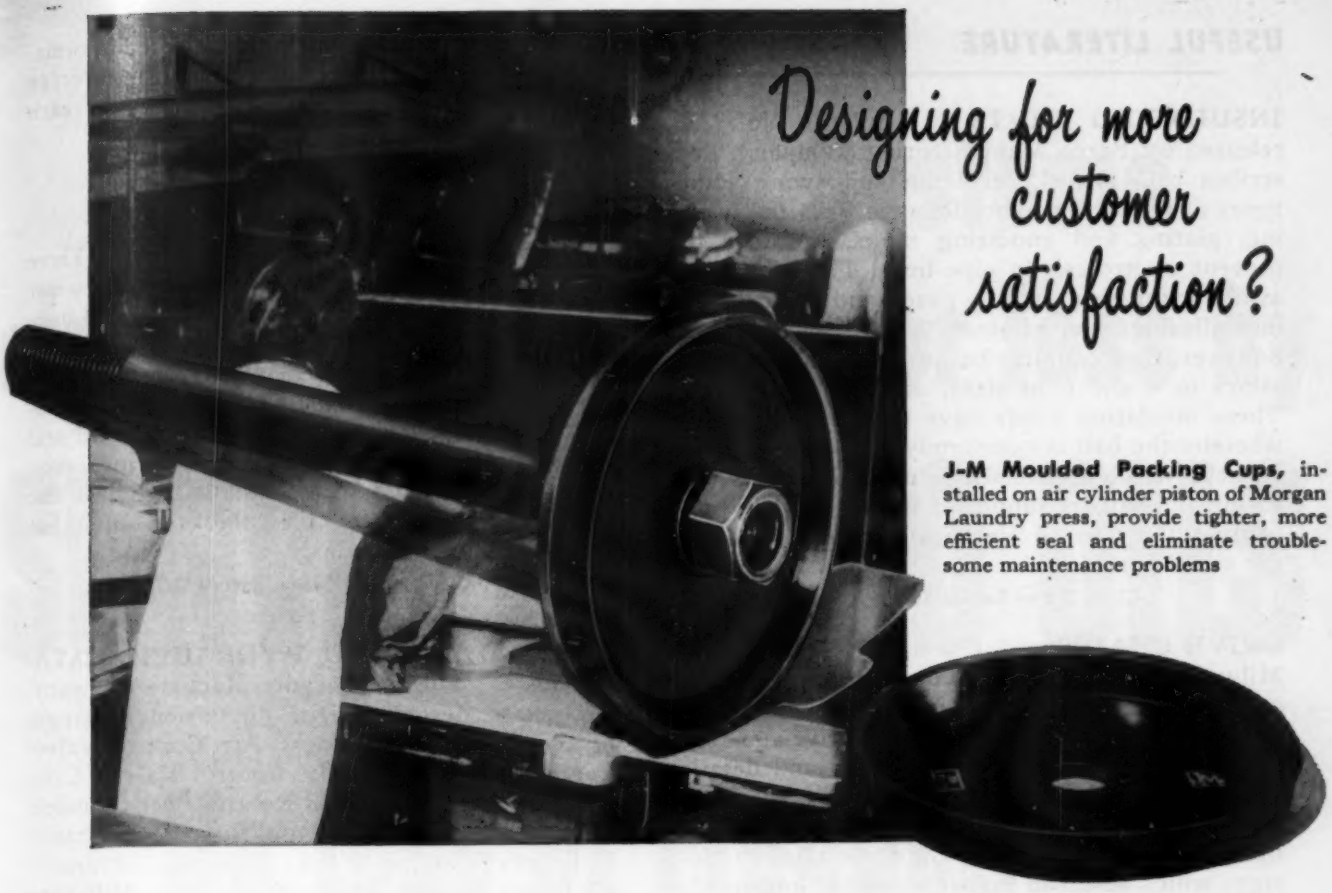
Circle 221 on Reader Service Card

**PNEUMATIC CONTROLLER** . . . Fischer & Porter Company has issued a four page catalog #53-11, which describes their new field-mounted pneumatic controller. The catalog shows a working sketch of this motion balance controller and includes schematic diagrams of three-line and four-line field-mounted control systems.

Circle 222 on Reader Service Card

**ELECTRONIC CONTROLS** . . . A new edition of "Cutting Production Costs with Electronic Controls" has been announced by Photoswitch Incorporated. The new edition contains 45 case studies. In each case a standard package electronic control solved a troublesome production or cost problem. Examples include timing, cycling, weighing, measuring and counting operations.

Circle 223 on Reader Service Card



*Designing for more customer satisfaction?*

**J-M Moulded Packing Cups,** installed on air cylinder piston of Morgan Laundry press, provide tighter, more efficient seal and eliminate troublesome maintenance problems

**When Morgan Laundry changed to J-M Moulded Packing Cups, they found**

# "Maintenance on packings practically eliminated . . ."

The Morgan Laundry, large supplier to hotels and institutions, encountered excessive down time for maintenance of their laundry presses. Packings supplied as original equipment on the air cylinder pistons of the presses needed frequent lubrication to prevent drying out. It was difficult to maintain proper cleanliness of the equipment.

When the company replaced the conventional material with J-M Moulded Packing Cups, packing life was increased. These packings required practically no maintenance, and the danger of soiling laundry because of relubricating packings was completely eliminated.

Designers and manufacturers can offer their customers many advantages by providing J-M Moulded Packing Cups on original equipment. These custom-made materials may be used on practically all types of air- or hydraulic-operated cylinders. They help improve operating efficiency, and they make possible easier, cleaner maintenance. These factors are especially important in critical installations such as hospitals and hotels, as well as laundries and other service establishments.

J-M Moulded Packing Cups are available in a variety of compositions to meet a wide range of pressures, temperatures and service conditions. For more information on all types of Johns-Manville Moulded Packing Cups, write to Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

JOHNS-MANVILLE JM PRODUCTS

**Johns-Manville PACKINGS & GASKETS**

## USEFUL LITERATURE

**INSULATING JOINTS** . . . Bulletin No. 223, released by Barco Manufacturing Company, describes ball, swivel, revolving and swing joint types of insulating joints for pipe lines to cleaning, plating and anodizing tanks, in order to prevent electrolysis in pipe lines. The joints are available for water, steam, gases, and other fluids, in malleable iron, in sizes ¼ to 3 in standard, however, they can also be furnished in steel and alloys in 4 and 6 in sizes, screwed or flanged. These insulating joints have the unique feature whereby the ball is completely supported in two gaskets, which are insulating material. Thus the casing and ball are supported by the gaskets, preventing the flow of electrical currents through the metal parts.

Circle 224 on Reader Service Card

**DRIVE CHAINS** . . . Chain Belt Company of Milwaukee has released a new bulletin #53-59 on its drive and conveyor " Chabelco" series chains. Exploded views of both the drive and conveyor chains show component parts and details of the chain construction. The advantages of the new R and RX (offset sidebar drive chains) and the RR (straight sidebar conveyor chains) designs which result in higher strength, longer life and smoother performance are outlined. A handy reference table, including chain part numbers, dimensional specifications and sprocket information is given. In addition to this the average ultimate strength and working loads of each chain are referenced.

Circle 225 on Reader Service Card

**SYNTHETIC RUBBER SEALS** . . . Three categories of seals—static, dynamic and wiper are briefly described and illustrated in an 8 page bulletin, issued by Dowty Seals Ltd. One page is devoted to the Dowty Bonded Seals—rubber bonded to metal rings—for both aircraft and industrial use. A chart showing the standard seal sizes furnished and illustrations showing cross-sectional views of typical seals, is included. The company's engineers are available to advise on special sealing problems.

Circle 226 on Reader Service Card

**REVISED AIR AND HYDRAULIC CATALOGS** . . . The Logansport Machine Company, announces design and/or dimensional changes in the following catalogs: Air Control Valves Catalog 100-4; Hydraulic Control Valves, Catalog 200-4; Stationary and Rotating Air Cylinders Catalog 100-1; 750 Series and Rotating Hydraulic Cylinders Catalog 200-3; Rotocast Hydraulic Cylinders Catalog 200-2; Heavy-Duty Mill-Type Air Cylinders Catalog 100-2.

Circle 227 on Reader Service Card


# Air and Hydraulic Cylinders

FOR HEAVY-DUTY AND STEEL-MILL APPLICATIONS

**TO MEET ALL SIZE AND PRESSURE REQUIREMENTS**

*8½-in. bore by 36-ft. stroke cylinder built by Lincoln for steel-mill equipment applications.*

*2-stage 5000-psi cylinder built by Lincoln for cold-extrusion press. Dimensions: 20-in. bore by 19-in. stroke, and 4-in. bore by 19-in. stroke.*

**BORES TO 36 IN. DIAMETER**
**STROKES OF 50 FT. AND LONGER**

LINCOLN MACHINE COMPANY will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunion, rod-end flange, blank-end flange, foot, clevis or center-line mountings.

Call on LINCOLN when you require large, powerful rotating or non-rotating hydraulic cylinders, heavy-duty mill-type cylinders, or standard hydraulic and pneumatic cylinders. Our engineering department will give you fast, practical assistance in design problems . . . AND our modern plant will build your cylinders quickly and economically.

**WRITE TODAY FOR LINCOLN'S CATALOG.** It gives engineering data on many types and sizes of heavy-duty cylinders.

**LINCOLN MACHINE CO.**

325 WEST 2nd STREET • SALEM, OHIO

Circle 111 on Reader Service Card

# Dirty Hydraulic Systems cleaned in 50 hours or less by SUNVIS H.D. 700 OILS

## No Loss of Production

**Sunvis H.D. 700 Oils**

- **remove sludge and gums without affecting packings**
- **pick up contaminants and carry them to the filter**
- **prevent rusting of clean parts**
- **are available in viscosities to suit all hydraulic pumps**

Learn more about the advantages of cleaning dirty hydraulic systems with Sunvis H.D. 700 Oils. Call your local Sun Office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AH-10.

**INDUSTRIAL PRODUCTS DEPARTMENT**

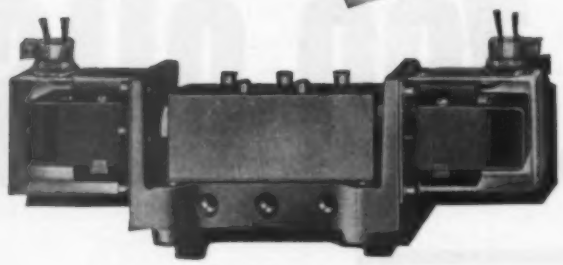
**SUN OIL COMPANY**

SUNOCO®

**PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL**

Quick-As-Wink
AIR AND HYDRAULIC
Control Valves

FEATURE THIS MONTH

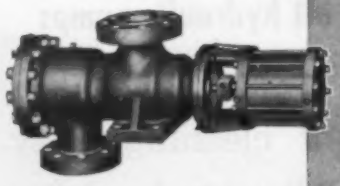


## 1/8" and 1/4" Double Solenoid Valves

**Their reduced amperage requirement simplifies electrical circuits**

● These valves are extremely simple in design — but ruggedly built — and will give millions of cycles of efficient, trouble-free, dependable operation. For air to 125 psi, vacuum, or low pressure hydraulic service. Up to 300 cycles a minute. Solenoid armature bears directly against the valve plunger eliminating levers, links, pins, etc. Low amperage requirement simplifies the electrical circuit. The valve is reversed by energizing first one solenoid, then the other. The valve and both solenoids are mounted on an aluminum base, and can be removed independently without disturbing the piping. 2-way, 3-way, double 2-way, 4-way and 5-way actions.

also the following

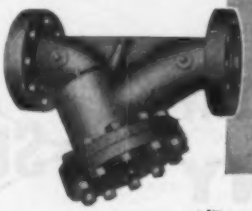


**DESCALING VALVES**

Specially designed for descaling hot strip and large steel forgings. Widely used. 2" to 6" sizes. Capacities to 1550 Gals./Min. Design eliminates destructive water hammer and reduces hydraulic shock to a minimum.

**HIGH PRESSURE STRAINERS**

Used ahead of descaling valves to prevent foreign material from plugging spray nozzles causing scale streaks in strip—also in hydraulic lines to protect valves, cylinders, and other machinery. 1½" to 6" sizes. Highly efficient. Easily cleaned.



*For Fully Descriptive Data Sheets Write*

**C. B. HUNT & SON, Inc.**

*Hand, Foot, Lever, Cam, Pilot, Diaphragm and Solenoid Control Valves*

1994 EAST PERSHING STREET • SALEM, OHIO

Circle 92 on Reader Service Card


## USEFUL LITERATURE

**SILICONE RUBBER PRODUCTS** . . . A new 8 page bulletin AD-147 describing many of the silicone rubber products made by The Garlock Packing Company has just been issued. The silicone rubber products described in the bulletin include diaphragms, gasketing, sheet packing, oil seals, rings, insulation tape, rod and valve stem packings and molded shapes for various industrial uses. Heat-resistant and aging-resistant features are pointed out and examples are included of typical applications.

Circle 228 on Reader Service Card

**HYDRAULIC JACKS** . . . A new general catalog No. 53, on its line of mechanical and hydraulic jacks, hydraulic pullers and special purpose jacks, has been issued by Templeton, Kenly and Company. The catalog is file-sized and contains 34 pages of application pictures and information, detail drawings, specifications, plus a full listing and illustration of all accessories and attachments that are available. A handy index is provided for quick reference. Included also is the remote controlled hydraulic jack, ratchet lowering jack, screw jacks and a variety of special purpose jacks such as mine roof jacks, trench braces, tie removers and replacers.

Circle 229 on Reader Service Card

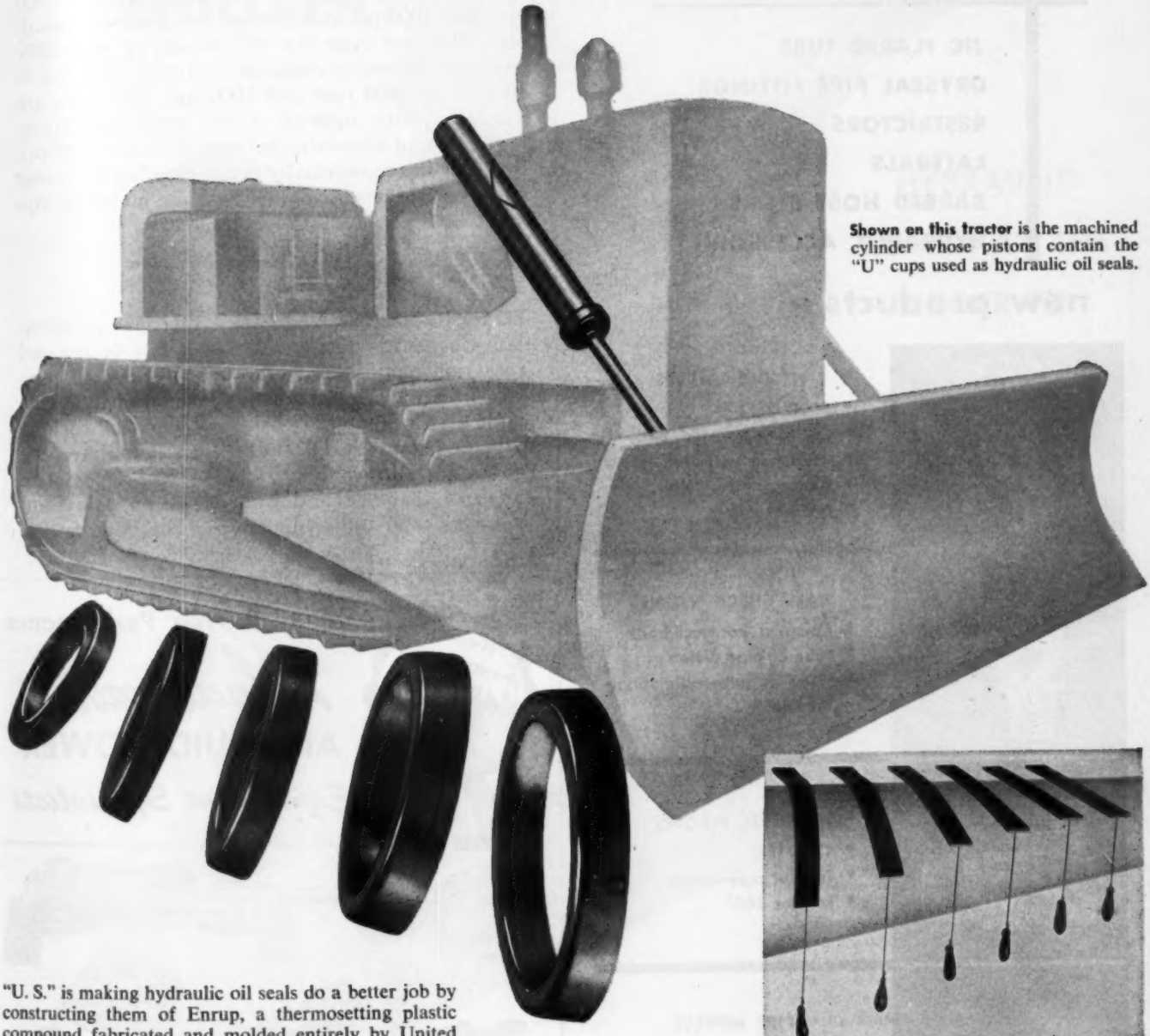
**VERTICAL TRIPLEX PUMP** . . . The Ajax TP-4000 Series Pump designed primarily for oil recovery, is also adaptable for industrial use in pumping oil, brines, and alkalis, solvents, wastes and other hydraulic pressure services. The pump is described in booklet #531, issued by Ajax Iron Works. Cross-sectional views of the pump show the distinctively simple design and construction. Specifications are given. Performance curves are graphically shown. The pump is of vertical design. It is a triplex high speed reciprocating unit, capable of continuous operation. The entire power end of the pump is enclosed, affording protection from the weather. Roller main bearings are provided.

Circle 258 on Reader Service Card

**QUICK COUPLER** . . . Catalog No. A718, released by Henry Valve Co., describes their Wave-Flow Quick Coupler, recommended for certain pneumatic and hydraulic line applications. A cross-sectional view of the coupler, together with features of its design are included. Two types of couplers are available. One has a swivel connecting cap so that no twisting of hose is necessary in connecting or disconnecting. The other has a connecting cap fixed in position on the plug half so that the hose must be twisted slightly in connecting or disconnecting.

Circle 259 on Reader Service Card

# What's U. S. Rubber doing with hydraulic oil seals?



**Shown on this tractor** is the machined cylinder whose pistons contain the "U" cups used as hydraulic oil seals.

"U. S." is making hydraulic oil seals do a better job by constructing them of Enrup, a thermosetting plastic compound fabricated and molded entirely by United States Rubber Company engineers. Five sizes of this seal are being used on machined cylinders on tractors and other heavy road-building equipment. These seals last much, much longer than the seals previously used.

Enrup has unusual abrasive resistance, can be molded to close tolerances, and can be machined. It has high impact strength and great toughness. You may find that Enrup is just what you have been seeking to improve your product. Consult any of the 25 "U. S." District Sales Offices, staffed with engineers to serve you, or write to address below.

**These are the "U" cups** made of Enrup, used as a hydraulic oil seal on tractors and other heavy road-building equipment.



**Between the extreme elasticity** of soft rubber (the strip at the extreme left) and the rigidity of hard rubber (strip at extreme right) are 4 strips of Enrup. Note varying degrees of flexibility, making Enrup a true bridge between hard and soft rubber.

U.S. RUBBER
SERVING THROUGH SCIENCE

***"U.S." Research perfects it***
***"U.S." Production builds it***
***U.S. Industry depends on it***

## UNITED STATES RUBBER COMPANY

**MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.**

**Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Grinding Wheels • Packings • Tapes Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting**

L and L

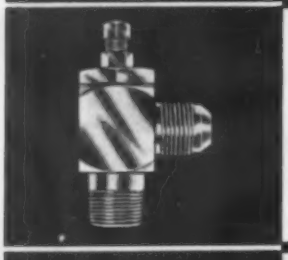
**STEEL HYDRAULIC COUPLINGS**

*"THE MOST COMPLETE FITTING LINE"*

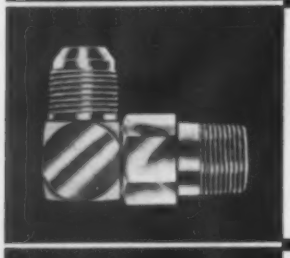
**JIC FLARED TUBE**
**DRYSEAL PIPE FITTINGS**
**RESTRICTORS**
**LATERALS**
**BARBED HOSE STEMS**
**HYDRAULIC ACCESSORIES**

**new products :**

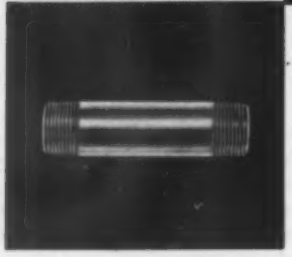
**NEEDLE VALVES**
- 5000 PSI
- Compact, bar stock body
- Use for shut-off or metering
- Tube or pipe outlets
- Line or angle



**BALL CHECK VALVES**
- Compact, bar stock body
- Tube or pipe outlets
- Fixed or adjustable spring loading



**SWIVEL ELBOWS**
- 1200 PSI
- Tube or pipe outlets
- Rotates 360°



**PIPE NIPPLES**
- Clean bore, seamless steel tubing
- Dryseal NPTF threads
- Cadmium plated

Representatives in principal cities
*WRITE FOR CATALOG #53*

L and L MANUFACTURING CO.
8088 E. NINE MILE RD.
VAN DYKE, MICH.


## *USEFUL LITERATURE*

**HYDRAULIC PUMPS** . . . A brochure presenting 8 models of external gear pumps is released by Oil Hydraulics Division Webster Electric Company. The types include the HB series, available in either face or wet sump mounting, or as sealed unit for sizes from 1.8 to 2.9 gpm at 1800 rpm and 1000 psi. An internal relief valve is available. Another type the HC series, an especially compact design, is available in 3 sizes from 5.4 to 10 gpm at 1800 rpm and 1000 psi. The units are available with internal relief valve permitting regulation of pressures between 500 and 1000 psi. Both series are especially recommended for power steering systems, machine tools and mobile equipment.

Circle 260 on Reader Service Card

**TUBING DATA CARD** . . . A new technical data card #154 designed to aid in the design and operation of tubular equipment at elevated temperatures and pressures has been issued by the Tubular Products Division of The Babcock & Wilcox Company. The data card tabulates the maximum allowable stress values of a complete range of seamless and welded carbon, alloy and stainless steel tubing and pipe. The data card is

**Seal of Proven Performance**

*Modernair*

**AIR/FLUID POWER**

*Equipment Specialists*

• Valves • Chucks • Cylinders • Silencers
• Solenoids • Hydraulic Pumps • Compressors
• Pilots • Air Controls • Machine Feeds
• Clamp Cylinders • Quiet Exhausts

Write for Catalog

*Stocks in Principal Cities*

*Modernair* CORPORATION

400 PREDA STREET • SAN LEANDRO, CALIFORNIA




Circle 107 on Reader Service Card

Circle 122 on Reader Service Card

# DIRECT HYDRAULICS IN HEAVY INDUSTRY

**HYDRAULIC POWER AT THE FINGER TIP**

Direct hydraulic power systems, powered by Electraulic High Speed Pumps, save money in the Shipyard — immune to frost — independent units not affected by demand of adjoining machines—any desired pressure immediately available—great economy of power and maintenance. The Electraulic All-Hydraulic Control System gives hydraulic pressure by finger-tip control, without solenoids.

***The Plate Edge Planing Machine is illustrated by courtesy of Hugh Smith (Possil) Ltd.***

**ELECTRAULIC**
REGD TRADE MARK

**HIGH SPEED PUMPS**

**DIRECT HYDRAULIC SYSTEM**

**TOWLER BROTHERS (PATENTS) LTD., RODLEY, Nr. LEEDS, ENGLAND**

Sole Agents: U.S.A. and CANADA:— MACMILLIN ENGINEERING CORPORATION
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*Fast-Rugged-Dependable*

AV AIR CONTROL VALVES

**3-WAY..4-WAY PILOT OPERATED VALVES**

Short operating stroke gives exceptionally high speed performance.

Uses small, low-power, nationally-known solenoids.

Small, compact, made with non-corrosive materials. 3-way (norm. open or closed) and 4-way operation full port sizes ¼", ⅜", ½" and ¾".

**3-WAY... 4-WAY SOLENOID OPERATED PILOT VALVES**

Direct acting—¼" pipe tap for pressures to 150 P.S.I.

Light aluminum construction.

Operates master valves, or small cylinders up to 3" in diameter.

**SPEED CONTROL VALVE**

Efficiently controls speed of piston rod of cylinder. Restricts air being exhausted from cylinder.

Used on air or hydraulics —pressures to 1200 P.S.I.

Sizes ¼", ⅜" ½" and ¾".

*Write for bulletin and attractive O.E.M. and quantity discounts*

**AUTOMATIC VALVE CO.**

37419 Grand River Ave.

FARMINGTON, MICHIGAN


## USEFUL LITERATURE

complete with notes and formulae for the calculation of the maximum allowable working pressures of tubing and pipe.

Circle 199 on Reader Service Card

**REVOLVING JOINTS** . . . The Rotherm Engineering Company is producing a new type of joint capable of handling all types of hydraulic steam and oil pressure at temperatures from —65 F to 500F. The new joints are described in Catalog No. 11. Features are no bearings, no lubrication and low turning torque for use on air, oil, water and gas. Three designated styles are furnished—without syphon, with stationary syphon and with rotating syphon. Complete dimensions are given for installation purposes, together with cross-sectional views. A research and development service is offered and is equipped, through their test laboratories to make all types AN specification tests on equipment, such as hydraulic, air steam and electronic equipment including salt spray tests of all types.

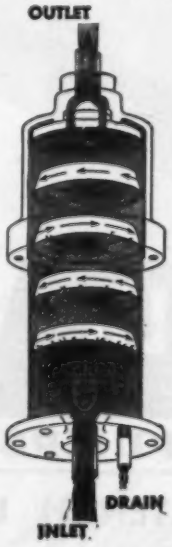
Circle 198 on Reader Service Card

**OIL FILTERS** . . . A new 12 page bulletin #MK-0553 describing its full line of Micro-Klean filters for liquid applications, has just been pub-


**EQUIPMENT LASTS LONGER ...PERFORMS BETTER... when the**

**ARIDIFIER**

**SCRUBS, CLEANS AND DRIES On Air and Gas Lines**



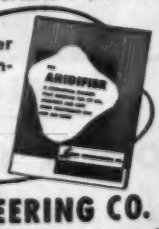

**LASTS LONGER because...**
The Aridifier's patented centrifugal-baffle action traps 92% of all dirt, oil, scale and water in gas or compressed air . . . and drains off these troublemakers *before* they can damage tools and equipment.

**PERFORMS BETTER because...**
The Aridifier protects tools against the freezing, fouling, caking and corrosion caused by dirt and foreign matter . . . assures the clean, dry air and gas that means better spray work, painting, lacquering, sand blasting, air cleaning, and similar operations.

**Easily installed, the Aridifier maintains itself. 10 models. Capacity range; 7 CFM to 17,000 CFM.**

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.

**Write for This Catalog Now!**



**Logan ENGINEERING CO.**

4920 W. Lawrence Ave., Chicago 30, Ill.

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Circle 3 on Reader Service Card

# Acme Gauges

**Custom built pressure gauges in all ranges from 15 to 30,000 psi, in dial sizes from 4½" to 12".**

***Write today for Bulletin 47***

**Acme Gauge & Instrument Co., Inc.**
**30 Main St. Brooklyn 1, N.Y.**

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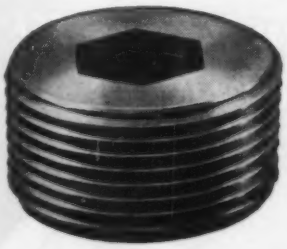

# UNBRAKO®

## dryseal-thread PRESSURE PLUGS

**HOW THEY WORK**

Internal Root Crushes External Crest Here

External Root Crushes Internal Crest Here

In tightening of UNBRAKO Pressure Plugs, the roots of the flattened threads actually crush the sharper crests of the mating parts. Major and minor diameters are positively sealed, pressure tight without compound. Stocked and sold by leading industrial distributors everywhere. Write for literature. SPS, Jenkintown 2, Pennsylvania.

*Our Fiftieth Year* : A START FOR THE FUTURE

**UNBRAKO SOCKET SCREW DIVISION**

**SPS**
**JENKINTOWN PENNSYLVANIA**

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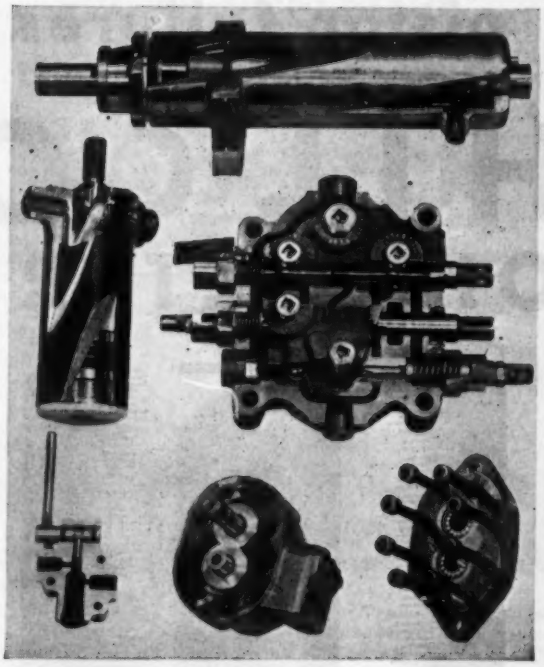
# HUSCO® PUMPS VALVES CYLINDERS



"HUSCO" manufactures a complete line of hydraulic cylinders, control valves, pump units, lever-operated check valves, swivels, and special controls. These include:

Pressure actuated reciprocating valves to actuate double-acting cylinders . . . the Series 3000 Control Valves, "the valve with the horseshoe ports" and a new 3500 Series Control Valve . . . relief and flow-control valves . . . hydraulic pumps to 1500 psi and 5 gpm capacity . . . hydraulic package power units . . . and . . .

**"HUSCO" CUSTOM BUILT HYDRAULIC CYLINDERS**
Complete lines of single-acting and double-acting cylinders, differential type, as well as telescoping cylinders, are available. All cylinders are built to customer application requirements. "HUSCO" cylinders are:

**(1) Designed to insure concentricity of guides which are piloted from the same diameter**

**(2) Adequately guided to prevent any bearing load against the packings—insuring full life of packings and safeguarding against leakage**

**(3) Provided with an adjust nut for take up on the packings**

**"HUSCO" welcomes the opportunity to provide engineering assistance on hydraulic problems and in developing new hydraulic equipment**

**Used on:**
**Construction, Industrial, Material Handling and Agricultural Equipment**

**HYDRAULIC UNIT SPECIALTIES CO.**
Pumps • Valves • Cylinders
WAUKESHA, WISCONSIN

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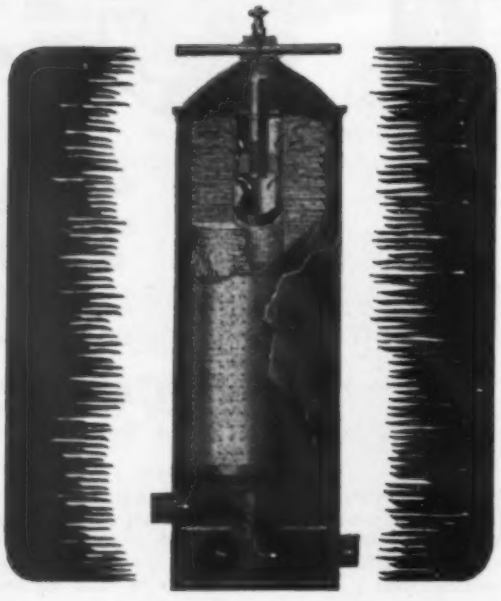
# Prevent
## Sludging
## Pump, valve and piston failures
*with*
# HILCO
# OIL FILTERS



SERIES "R" FILTER

Oil contamination is one of the largest single causes of hydraulic equipment failure. Eliminate dirty oil with HILCO filters . . . keep your oil clean by removing products of oxidation, acids, sludge and moisture. Increase the life of your oil and cut costly downtime with HILCO filters.

Years of experience and dependable service make **HILCO** your best filter buy.

★ *Recommendations at No Obligation*
*FREE Descriptive Bulletin*

THE HILLIARD CORPORATION
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## USEFUL LITERATURE

lished by the Cuno Engineering Corporation. Six series of standard models for flows between 1.8 gpm and 900 gpm are illustrated and described with full specifications. Maximum operating pressures of standard units range from 125 psi to 1000 psi. Features of the Micro-Klean design including graded density in depth, resinous impregnations of felting fibres and high porosity are described. Applications, standard dimensions, case histories and a selector chart, to be used as a guide in choosing the proper filter under normal conditions, are included. A full page of hydraulic data covering such items as viscosity conversion tables, hydraulic formulae, dimensional comparisons (mesh, inches and micronic) and representative micronic comparisons is included.

Circle 45 on Reader Service Card

**AIRCRAFT ELECTRIC MOTORS** . . . A total of 22 models of aircraft electric motors are illustrated and described in a new Bulletin No. 1535, just issued by U. S. Electrical Motors Inc. Motors described are 1/20 to 16 hp, high frequency induction type, 3-phase alternating current, used for various controls in aircraft components. Many of the models include built-in gearing. Totally-enclosed explosion proof types as well as built-in brakes for instant stopping are also included.

NEW MARSH
*Serviceman Soundscope*
*. . . cuts servicing and maintenance costs*

Most effective instrument ever developed for pin-pointing and identifying mechanical defects. Saves time and dollars tracking down troubles in bearings, gears, mechanisms . . . detects leaks, knocks, piston slaps—any defects that make a sound. A precision instrument of Marsh quality, sensitive to faintest sounds . . . with handy probe and headband as illustrated. A remarkable tool, moderately priced.

*Ask for Circular*

**MARSH INSTRUMENT CO.**
*Sales affiliate of Jas. P. Marsh Corporation*
Dept. 19, Skokie, Illinois




Circle 89 on Reader Service Card

Circle 117 on Reader Service Card

Several illustrations show methods of testing aircraft motors under conditions that simulate altitudes as high as 80,000 feet.

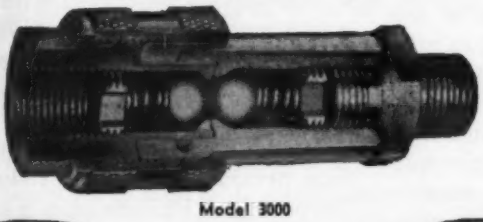
Circle 182 on Reader Service Card

To order your free copies of literature offered in these columns, use the convenient Reader Service Card. You'll find it bound between pages 192 and 193.

REMOTELY OPERATED VALVES . . . Remotely operated valves, designed for use when it is practical to place the relief valve in a normally accessible location or near other machine controls, is described in new catalog sheets just issued by Fluids Control, Inc. The remotely operated valve is a pilot type relief valve with an internal pilot valve and provision for connecting one or more external pilot valves. The data sheets contain detailed information on use, operation and construction. Specific data on models available, pipe sizes, dimensions, weights and rates are also included.

Circle 67 on Reader Service Card


HYDRAULIC and PNEUMATIC QUICK COUPLERS THAT DO THE JOB!



Model 3000

- Guaranteed not to leak
- Amazing free area
- Easy to couple and uncouple
- High quality—Low Cost
- Sizes: ⅜", ½", ¾"

Model 4000

**Pressure Ranges**

Model 3000—Zero to 30,000 psi for burst. (for operating pressures up to 15,000 psi)

Model 4000 and 5000—Zero to 10,000 psi for burst. (for operating pressures up to 6,000 psi)

Models 4000 and 5000 easily converted to "Break-away" types by using our Break-away Clamp.

Dust Plugs and Caps available for all Couplers

Model 5000

*Please write for complete Literature*

**Pioneer Hydraulics, Inc.**

121 No. 1st St. Minneapolis 1, Minn.

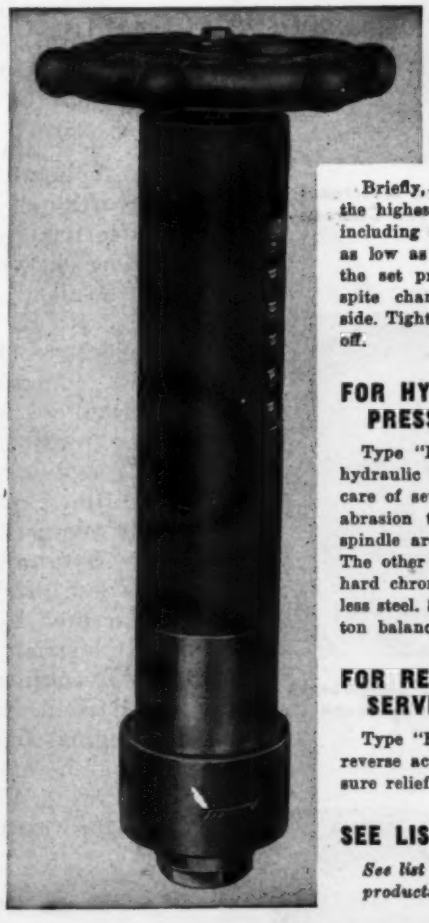


THIS IS IT-

The ATLAS Type "E" HIGH PRESSURE REDUCING VALVE.

NO SHOCK

Even at pressures as high as 6,000 pounds per square inch ATLAS Type "E", shown here, handles the air, oil, or water *without shock.*



ASK FOR DATA

Briefly, Type "E" reduces the highest initial pressures, including 6,000 psi, down to as low as 100 psi. It holds the set pressure closely despite changes on the inlet side. Tight on dead end shut-off.

FOR HYDRAULIC PRESSES

Type "E" is excellent for hydraulic presses. To take care of severe corrosion and abrasion the seat ring and spindle are STELLITED. The other internal parts are hard chromium plated stainless steel. Spring loaded. Piston balanced. Self-contained.

FOR RELIEF SERVICE

Type "E" is also available reverse acting for high pressure relief valve service.

SEE LIST

*See list of other ATLAS products below.*

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

253 South St. Newark 5, N. J.

*Represented in Principal Cities*

Campbell Boiler Feed Regulator
Temperature Regulators
Reducing Valves
Exhaust Control System
Pressure Regulators
Pump Governors
Damper Regulators
Back Pressure Valves
Balanced Valves
Control Valves
Float Valves

# Post Scripts of Industry

**News about people, manufacturers and sales organizations**

*John Mestrezat*
*J. N. Fauver Company, Inc.*

*Clark Langworthy*
*The Parker Appliance Company*

*F. R. Dickerson*
*Geo. D. Roper Corp.*

The appointment of **John Mestrezat** as a vice president has been announced by J. N. Fauver, president of **J. N. Fauver Company,** Inc., 51 West Hancock, Detroit 1, Michigan. Mr. Mestrezat was formerly a senior sales engineer for Fauver covering the Saginaw Valley area. He has served the company since 1944.

Appointment of **Clark Langworthy** as chief engineer for industrial hydraulic products of **The Parker Appliance Company,** Cleveland, Ohio, is announced by R. H. Davies, engineering manager. Parker, is expanding its efforts in the field of hydraulic system components for application on machine tools and on mobile equipment. As a phase of this expansion Parker recently acquired the Sundstrand line of hydraulic valves and pumps. These products now are manufactured by the company's new Industrial Hydraulics division. All engineering activity of the division, including production engineering and an extensive research and development program, will be directed by Mr. Langworthy.

**F. R. Dickerson** was elected vice president and general manager of the **Geo. D. Roper Corporation,** pump division. He started his business career with Roper as sales engineer in 1936, became sales manager in 1948 and general manager of the pump division in 1951. Stanley H. Hobson, president of the Geo. D. Roper Corporation, also announced other organizational changes: **C. R. Oehler,** assistant treasurer and controller, was appointed treasurer. **B. R. Jensen,** works manager and vice president of the ordnance division is now operations vice president. **J. H. Makemson,** vice president and treasurer, becomes vice president and general manager of the appliance division. **E. C. Sorby,** vice president in charge of appliance sales, is the new vice president in charge of trade and public relations. **H. D. Weigel,** assistant works manager for the appliance and ordnance divisions, was named general manager of the ordnance division. **C. A. Miller,** assistant controller, was appointed controller. **W. F. Hinz,** assistant secretary, also becomes assistant treasurer.

**David W. Hopkins,** executive vice president of R-S Products Corporation, Philadelphia, a subsidiary of S. Morgan Smith Co., York, Pa. has been appointed chief consultant for the Valve Division of **S. Morgan Smith Company,** with offices in Philadelphia and York.

**A. R. Abelt** formerly vice president in charge of field forces for **Chain Belt Company** of Milwaukee is appointed vice president—sales. **George W. Woodland** is appointed to the newly created position of manager of field forces for the company's industrial divisions. **Gilbert J. Schuelke** is now sales manager of the Chain and Transmission division. **W. C. Messinger** is the newly appointed as-

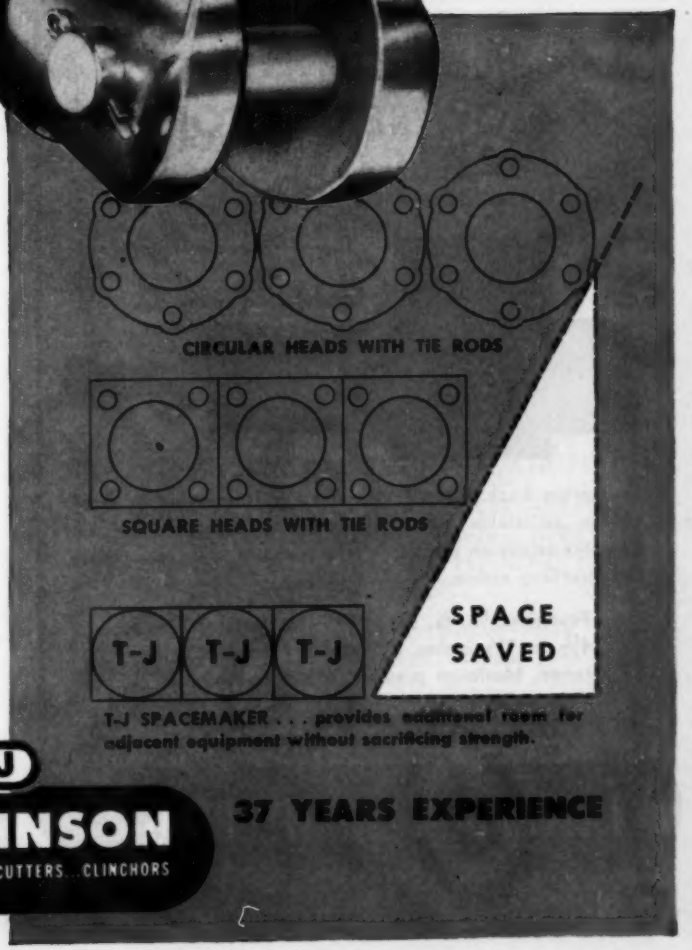
# LESS SPACE!

## extra high safety factor!

## NEW T-J Spacemaker AIR CYLINDERS

These new T-J Cylinders *save up to 40% in mounting space*—with streamlined design that eliminates tie rods. They're *super rugged*—extra high safety factor . . . solid steel heads . . . heavy wall, precision honed, hard chrome plated, seamless steel body . . . leakproof cylinder head to body construction . . . heavy duty, hi-tensile, hard chrome plated piston rod.

Available with the new T-J Super Cushion Flexible Seals which insure positive cushion with automatic valve action for fast return stroke. Many standard sizes and styles . . . for pushing, pulling, lifting, clamping or control jobs. T-J dependability. Write for bulletin 8152. The Tomkins-Johnson Co., Jackson, Mich.




T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

4 Weeks Delivery on the Spacemaker—any style, any stroke, 1" to 3" diam.

T-J

**TOMKINS-JOHNSON**

RIVITORS . . AIR AND HYDRAULIC CYLINDERS . . CUTTERS . . CLINCHORS

37 YEARS EXPERIENCE



Circle 175 on Reader Service Card

Continued

sistant to A. K. Thomas, divisional manager of Chain Belt's Construction Machinery division. **R. V. Krikorian** is appointed to succeed W. C. Messinger as manager of the Ordnance division. **Roland V. Poisson,** who has been assistant sales manager has been appointed sales manager, Baldwin-Duckworth division.

Two sales departments of **Monsanto Chemical Company's** Organic Chemicals Division have been combined into a single new department of Petroleum Chemicals and Functional Fluids Sales Division. The announcement was made by John L. Hammer Jr., general manager of sales for the division. He said that **John W. Newcombe** had been named manager of the new department. Two former sales groups which are now merged will function as sections of the new department. The petroleum chemicals section will handle a tailored group of chemicals called oil additives and designed for specific automotive and industrial lubricant applications. The functional fluids section will be concerned with the sale of nonflammable type hydraulic fluids for aircraft and industrial applications. **John S. Harris** has been appointed as supervisor of the functional fluids sales section. Harris succeeds **Harold F. Shattuck,** formerly manager of functional fluids sales, who will devote his time to tariff matters for the division. Harris will be assisted by **Francis H. Langenfeld.**

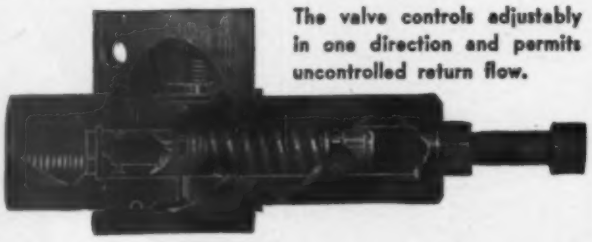
The election of **Chester A. Siver** as vice president and general manager of engineering, **Black, Sivalls & Bryson, Inc.,** Kansas City was announced by Kenneth W. Lineberry, president.

**Joseph J. Samter**
**Chicago Belting Co.**

**Joseph J. Samter** has recently been appointed general sales manager of the **Chicago Belting Company.** He formerly was sales representative and district hydraulic engineer for the Chicago division of the E. F. Houghton Company of Philadelphia. Mr. Samter replaces Kenneth B. Stiles who resigned to head his own business.


**An adjustable FLOW REGULATOR**

This newly perfected adjustable Flow Regulator holds at a constant rate even though the pressure fluctuates.



The valve controls adjustably in one direction and permits uncontrolled return flow.

The spring back piston in the housing is mounted in front of the adjustable screw. It carries a calibrated orifice; operates axially on change in inlet pressure so as to increase the throttling action.

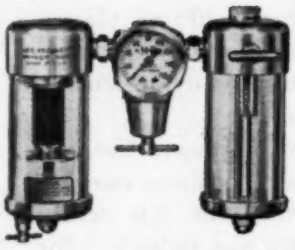
Four sizes, 1/4, 3/8, 1/2, and 3/4 inch. Overall length, 4 1/2 to 7 1/2 inches. Adjustable over a 50% flow range. Maximum pressure is 3000 pounds.

*Write for illustrated circular A*

WATERMAN ENGINEERING Company
725 CUSTER AVENUE
EVANSTON ILLINOIS

*Prominent User Acclaims*

**"M-B" Automatic Air Line FILTER, REGULATOR and LUBRICATOR Assembly**



The value of "M-B" Automatic Air Line Filters, Regulators and Lubricators is widely known for their effectiveness as a protection to Air Valves, Cylinders, Pneumatic Tools, etc.

"Your 'Sentinel of the Air Line' has been giving us very good service. We have had no complaints at all and I trust that we will be ordering more of them in the near future."

*signed:* **A. E. Cranston, Sr.**
*PRESIDENT*
Cranston Steel Strapping Co.
Oak Grove, Oregon

*WRITE FOR LITERATURE*

M·B PRODUCTS
46 Victor Ave.
DETROIT 3, MICHIGAN




Circle 193 on Reader Service Card

Circle 119 on Reader Service Card 

**Conrad H. Hoeppner** has been appointed manager, electronics projects department of the **W. L. Maxson** Corporation, New York, N. Y.

Addition of three engineers to the Cleveland, Buffalo and Detroit district sales of the **Reliance Electric & Engineering Company** is announced by E. E. Helm, sales vice president. These engineers, who already have taken over their new assignments, are: **Donald L. Peterson** in Cleveland, **David H. Rush** in Buffalo, and **John E. Harger** in Detroit.

Appointment of **Fred Kaiser** as manager of the eastern region of **Minneapolis-Honeywell Regulator Company,** with headquarters in New York, was announced recently by Tom McDonald, vice president in charge of sales. **Arnold Michelson,** who has been handling the regional manager's duties, has been given additional duties and responsibilities as resident vice president. He will continue to make his headquarters in New York.

Henry A. Roemer, Jr., president of **Sharon Steel Corporation,** announced the appointment of **Wilbur T. Blair** as vice president and treasurer.

Announcement of the appointment of **D. C. Sanford** to the position of manager of the application engineering department of The Bristol Company, Waterbury, Conn., has been made by Harry E. Beane vice president-sales. Announcement is also made of the appointment of **F. W. Borchers** as general sales manager.

Addition of five industrial sales engineers to the **Parker Appliance Co.** staff has been announced by D. W. Holmes, vice president in charge of sales and D. A. Cameron, industrial sales manager. The new men and their assigned territories are: **Thomas Kramer Jr.,** eastern Pennsylvania; **Robert B. Wilson,** northern New Jersey; **John C. Watson,** Philadelphia and southern New Jersey; **R. Gurden Miller,** Connecticut and Rhode Island, and **Robert N. Boucher,** Metropolitan New York area.

Elevation of Brig. General **Stanley E. Ridderhof,** U.S.M.C., ret., to vice president of **Rosan Inc.,** Newport Beach, Calif., was announced by Jose Rosan, president.

**The Satullo Company** of 7635 East Jefferson Avenue, Detroit, Michigan has been appointed representative for **G. C. Wilson & Company** of Chatham, New Jersey. The Satullo Co., which has a branch in Cleveland, Ohio, will cover sales in Ohio, Michigan and western Pennsylvania.

Remove oil and moisture from compressed air swiftly . . . economically . . . safely. Most efficient aftercooler available. The secret? Inner-fins! Maximum heat transfer with minimum pressure drop. Sizes from 1 to 15 HP. Write for free bulletin containing complete specifications.

THE HEAT-X-CHANGER CO., Inc.
BREWSTER - NEW YORK

Circle 88 on Reader Service Card

DOUBLE SEAL
HYDRAULIC
PISTON RINGS

SEAL THE WALL OF THE CYLINDER AND SEAL THE GROOVE OF THE PISTON IN YOUR HYDRAULIC AND PNEUMATIC APPLICATIONS.

PROVEN IN THOUSANDS OF ORIGINAL EQUIPMENT AND REPLACEMENT APPLICATIONS IN ALL TYPES OF HYDRAULIC AND PNEUMATIC EQUIPMENT.

Write for Literature and Chart on Recommended Ring and Piston Groove Specifications.

DOUBLE SEAL RING CO.
2065 MONTGOMERY ST., FORT WORTH, TEX.
FACTORIES IN
FORT WORTH
LOS ANGELES, CALIF.
NEW ROCHELLE, N. Y.
MONTREAL, CANADA

Circle 54 on Reader Service Card

## Post Scripts of Industry

Continued

New quarters for the Los Angeles branch of the **Durametallic Corporation** of Kalamazoo, Michigan have been established at 4935 E. Olympic Blvd. **Fred G. Robb**, who has represented Durametallic on the west coast for over thirty years, will continue as manager. The staff will consist of **Earl Rogers**, sales and service engineer, **Rodney L. Rothwell**, recently arrived from the main offices in Kalamazoo, in charge of the service department, and **Mrs. Laura Kreitz**, secretary.

Appointment of **John F. Scherer** as dealer sales manager of the **Dudco Division**, The New York Air Brake Company, Hazel Park Michigan, has been announced by Borje Rosean, Dudco sales manager. Scherer has had long association with the hydraulics industry, most recently with Ar-Ka Engineering, Incorporated, St. Louis, Missouri, a Dudco Division dealer, where he was manager of the air and hydraulic division.

BOOST PUMPS
High Pressures
Low Prices
SPRAGUE
Measures
8¼" wide x 9⅝" deep.
Boost 100 PSI. air pressure to 10,000 PSI. fluid pressure for $173.25 (FOB Gardena, Calif.). Eight standard models for output fluid pressures of 1,000 to 30,000 PSI. Special models for lower or higher pressures.
Applicable wherever low volume output at high pressures is the requirement. For oil or water service. Complete power packages also available. Send for bulletins.
Assembly No. | Ratio | Maximum Fluid Pressure | Prices, F.O.B. Gardena, Calif.
216-C- 10 | 10:1 | 1,000 PSI. | $220.00
216-C- 20 | 20:1 | 2,000 PSI. | 210.00
216-C- 35 | 35:1 | 3,500 PSI. | 173.25
216-C- 60 | 60:1 | 6,000 PSI. | 173.25
216-C-100 | 100:1 | 10,000 PSI. | 173.25
216-C-150 | 150:1 | 15,000 PSI. | 194.50
216-C-200 | 200:1 | 20,000 PSI. | 225.00
216-C-300 | 300:1 | 30,000 PSI. | 289.50
SPRAGUE
Engineering and Sales Corp.
1144 West 135th Street, Gardena, California

**C. R. Hohmann**
**Warner Division**
**Detroit Harvester Company**

**Carl L. Kalitta**
**Warner Division**
**Detroit Harvester Company**

The promotion of **Carl L. Kalitta** to chief engineer and **C. R. Hohmann** to assistant chief engineer of the recently acquired Warner Division of the Detroit Harvester Company was announced today by J. Thomas Smith, Detroit Harvester Company president as another move in the expansion program for the Warner Division. These appointments were made by Jack P. Pedersen, division manager.

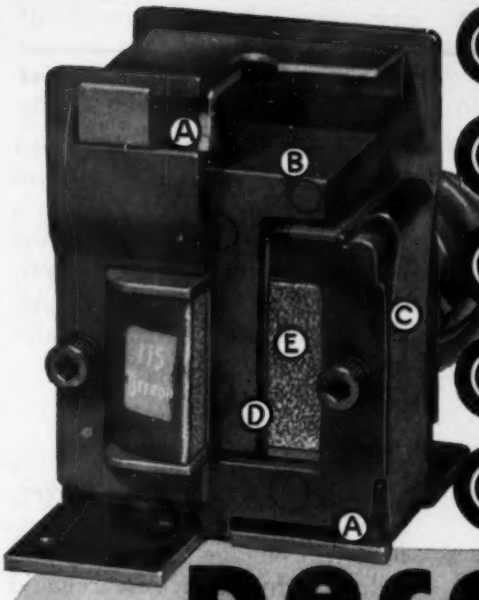
**Hufford Machine Works Inc.**, El Segundo, California, recently announced the formation of a new Electronic Division of the company, according to J. A. Helget, president. Located in a new,

10,000 square foot plant at 2201 Carmelina Ave., Los Angeles, officers of the new division are J. C. Washington, sales manager, B. J. McComb, chief engineer, and J. R. Frost, in charge of government negotiations.

**Henry C. Earle, Jr.,** has been appointed sales manager of **The Annin Company,** Los Angeles. Working out of Annin's Los Angeles office, Mr. Earle will devote himself to outside distributor contacts mainly in sales and application engineering.

**Chain Belt Company** recently opened a new Philadelphia warehouse to serve the New England and Middle-Atlantic states. The warehouse occupies a new building at 4125 Whitaker Avenue, Philadelphia. The building occupies 15,000 square feet and houses the company's Philadelphia district sales office. William Sivyer, district sales manager will head the warehouse activities.


Circle 50 on Reader Service Card




(A) Shock-absorbing bumpers cushion stroke, assure longer service life.

(B) Silicon steel laminations give high efficiency.

(C) Tempered steel spring absorbs vibration — holds assembly firmly in alignment.

(D) Hardened beryllium-copper plunger guide reduces friction and wear.

(E) Heavy Formvar insulated magnet wire on high flow point molded nylon bobbin.

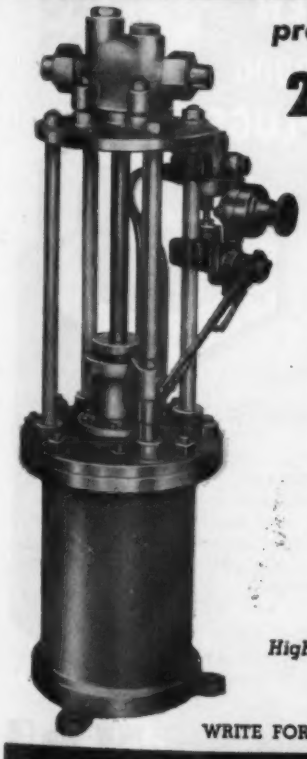
**Decco INDUSTRIAL SOLENOIDS**

Built better for longer service.
Shock mounted to reduce self-destruction.
Designed to meet J. I. C. specifications.
Four to twenty pounds—push or pull.
Stroke to one inch maximum.
A. C. or D. C. models.

*Special solenoid problems engineered to your needs.*

**DETROIT COIL COMPANY**
2435 HILTON ROAD • DETROIT 20, (FERNDALE) MICHIGAN

**AIR-HYDRO-PUMP**



*produces and holds*

**27,200 PSI**
**Hydraulic Pressure**
(air required—100 lbs. psi)

- Air-Hydro-Pump is the world's finest pressure unit for rapid testing of Valves, Boilers, Piping, Pressure Vessels.
- Sustains constant pressure on Rolls, Rams, Presses.
- Portable for site testing.
- Water, Oil, Diluted Alkalis and Acids can be used.
- Made of non-ferrous metals.
- Fully automatic, holds any pressure indefinitely.
- Complete range of 34 models single or double acting.

*High Pressure Control Valves to 30,000 p s i Also Available*

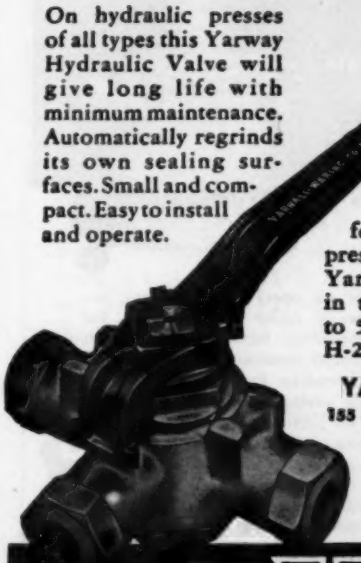
WRITE FOR DETAILS

**DAVIES BROS.** 120 WALL STREET NEW YORK 5, N. Y.

PUMPS FOR EVERY ENGINEERING NEED

**The Higher the Pressure ...the Tighter the Valve**

On hydraulic presses of all types this Yarway Hydraulic Valve will give long life with minimum maintenance. Automatically regrinds its own sealing surfaces. Small and compact. Easy to install and operate.



Yarway Single-Pressure Hydraulic Valves are made in straightway, three-way and four-way types; in five sizes for pressures up to 5000 lbs. Also Yarway Two-Pressure Valves in two sizes for pressures up to 5000 lbs. Write for Bulletin H-210.

**YARNALL-WARING CO.**
185 Mermaid Ave., Philadelphia 18, Pa.

**YARWAY**
Improved Type
**HYDRAULIC VALVE**

## Post Scripts of Industry

Continued

**Alexander T. Daignault** joined **Westinghouse Air Brake Company** on September 1, in the newly created office of vice president in charge of finance.

*Charles J. Betz*
*Standard Pressed Steel Co.*

**Raymond N. Gruber** has been named director of marketing research at the **Standard Pressed Steel Co.**, Jenkintown, Pa. **Charles J. Betz** was advanced into Gruber's former post of sales manager of the company's Unbrako line of socket screw products. **John W. Breitmayer,** of the Unbrako sales staff, succeeded Betz as assistant sales manager of the line.

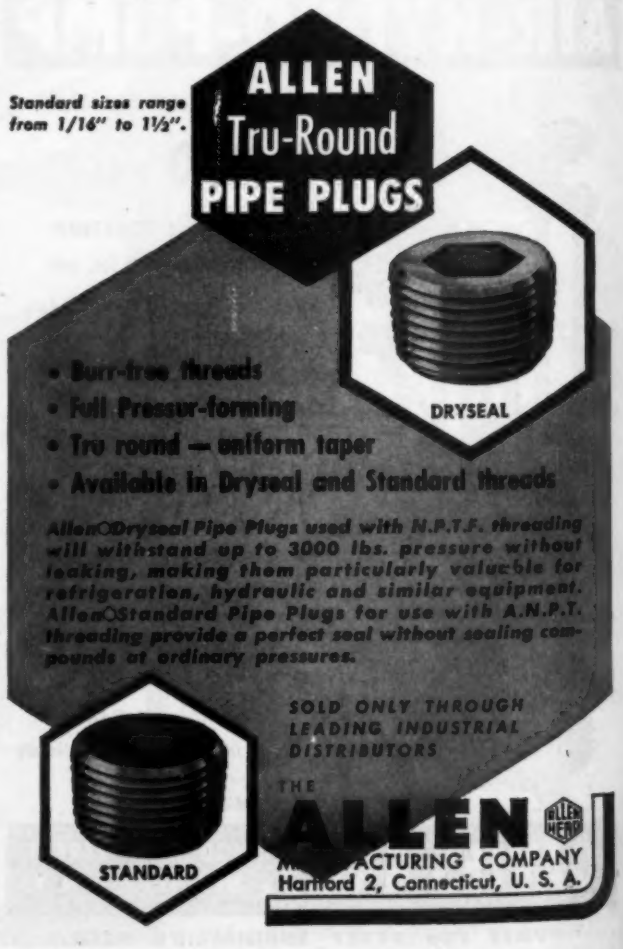
**John W. Overbeke** announces the formation of **John W. Overbeke and Associates.** The new firm will engage in aircraft and industrial hydraulic research and development consulting work. Offices will be established in the Blackstone Building in Cleveland.

**The C. B. Herrick Mfg. Corp.** of Cleveland, Ohio is building a line of standard equipment for automatic welding to be marketed by dealers throughout the country. **Clayton B. Herrick** is president of the corporation; **Willard C. Gunzelman** is vice president of engineering and production; **Jack J. Jarms** is vice president of sales.

**The Parker Appliance Co.** of Cleveland announces that the operations of its subsidiary—Synthetic Rubber Products Co. of Los Angeles—are being merged with those of Parker's Rubber Products Division. Henceforth, the Los Angeles facility will be known as the Rubber Products Division, Parker Appliance Co., 1538 South Eastern Avenue, Los Angeles 22, California.

John M. Dolan, vice president and general sales manager of **The Hydraulic Press Mfg. Co.,** Mount Gilead, Ohio has announced the appointment of **Dean M. Cochran** as assistant sales manager. In addition to

Use
POWERMATIC
AIR HYDRAULIC
PUMPS
For Safe, Positive, Accurate Pressures to 25,000 p.s.i.
Size 9½" x 14" high
Weight 35 pounds
POWERMATIC
LONG LIFE
LOW COST
SMOOTH
FAST
PORTABLE
The air operated Powermatic hydraulic pump is engineered for continuous service at maximum capacity without overheating or overloading. Provides positive variable pressure control. Streamlined —no protruding parts to catch or damage. Hundreds of uses—operating rams, jacks, pipe benders, presses, hydraulic body and frame straighteners, lab testing, etc. Send for catalog and prices.
Distributors Inquiries Invited
POWERMATIC INC
1944 E. MARKET ST. • AKRON 5, OHIO


Standard sizes range from 1/16" to 1½".
ALLEN
Tru-Round
PIPE PLUGS
DRYSEAL
• Burr-free threads
• Full Pressur-forming
• Tru round — uniform taper
• Available in Dryseal and Standard threads
Allen Dryseal Pipe Plugs used with N.P.T.F. threading will withstand up to 3000 lbs. pressure without leaking, making them particularly valuable for refrigeration, hydraulic and similar equipment. Allen Standard Pipe Plugs for use with A.N.P.T. threading provide a perfect seal without sealing compounds at ordinary pressures.
SOLD ONLY THROUGH LEADING INDUSTRIAL DISTRIBUTORS
STANDARD
THE ALLEN MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.




Circle 146 on Reader Service Card

Circle 11 on Reader Service Card

administrative sales activities, Cochran is also named manager of Metalworking and Process Press Sales Division. H-P-M also has announced the appointment of **W. M. Truska, Jr.** as European sales representative for its new manufacturing center in the Netherlands.

**Republic Manufacturing Company** of Cleveland announces the appointment of new distributors: Florida Metals, Inc., 222 North 12th Street, Tampa, Florida; E. D. Sweetland Company, 405 Montgomery Street, San Francisco, California; Pace-Turpin Company, 726 South Third Street, Salt Lake City, Utah; and Palmer Supply Company, 222 Westlake Avenue, North Seattle, Washington.

Two executive changes have been announced by **Chain Belt Company** of Milwaukee. **J. C. Merwin** has been elected by the Company's Board of Directors to the position of Chairman of the Board. **L. B. McKnight** was elected to succeed Mr. Merwin as president and chief executive officer of the company.

**William M. Steffen** has been appointed general supervisor of materials and process engineering for **Northrop Aircraft, Inc.** of Hawthorne.

C. E. Cleminshaw, executive vice president of **Parker Aircraft Co.**, Los Angeles, wholly owned subsidiary of the Parker Appliance Co., Cleveland, Ohio has announced the following promotions: **F. E. Amon,** has been named vice president in charge of sales. **R. J. Trivison,** has been elected vice president in charge of manufacturing. **Warner B. McCarthy** secretary-treasurer.

**The B. W. Rogers Company,** having major facilities in Akron, is expanding its Cleveland operations to include warehouse facilities to stock accessory hydraulic equipment. This is part of a program to increase its facilities by opening branch offices and warehouses in key industrial areas in Northern Ohio.

**William G. Hill** has been named a sales engineer for **General Dynamics Corporation's** Electro Dynamic Motor and Generator Division. Mr. Hill will serve in New England.

**Willard D. Squires,** former assistant to the controller of the **Westinghouse Air Brake Company** has been elected to the position of controller to succeed George V. Myers who resigned to take another position.

**G. E. "Ed" Burks** has been appointed director of engineering of the **Caterpillar Tractor Co. John E. Jass** succeeds Mr. Burks as chief engineer of the Peoria


The
**DARCOID COMPANY,** INC.

MANUFACTURERS & DISTRIBUTORS
*"O"-Rings
*Custom Molded Products

Take advantage of our complete O-Ring service facilities. Comprehensive O-Ring stocks of Dash Numbers 6227, 6230 and 6290 Series to meet specifications MIL-P-5516 and MIL-G-5510 immediately available to meet your immediate and long range requirements.

*Write or phone for design and installation data and O-Ring Catalog*

Authorized Distributors for the Goshen Rubber Company on all Specification Molded Parts.

**145a Sixth Ave. New York 13, N. Y.**
*Phone ALgonquin 5-1393*

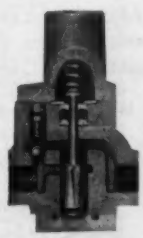
COMPACT | DEPENDABLE | EFFICIENT

Double acting hinge mounting BHEW hydraulic cylinder.

**BHEW HYDRAULIC CYLINDERS**

It's easy and practical to use BHEW hydraulic cylinders in your applications. Accurately honed barrels, hard chrome-plated rods, small O. D. and any type mounting desired are BHEW cylinder features. All types and sizes available in standard and special O. E. M. designs. BHEW makes single and double acting, high and low pressure cylinders with cup-type, ring-type or O-ring construction. Send specifications of your requirements.

**BHEW** Pressure Operated Hydraulic Flow Control Valves, for lift trucks, eliminate surge as load starts down. Load weight controls rate of descent, full speed raising and empty fork travel. Write for details.



**BENTON HARBOR ENGINEERING WORKS**
BENTON HARBOR, MICHIGAN

Continued

plant. **Paul B. Benner** becomes assistant chief engineer at the Peoria plant with supervision over design of motor graders and wheel tractors. **Carl L. Kepner** becomes assistant chief engineer with supervision of earthmoving equipment now manufactured at the Joliet plant.

**New York Belting and Packing Co.** has announced three changes in its district sales organization. **William I. Butler,** manager for the southeastern district, with offices in Memphis, has been named district manager for the east central states with offices in Cleveland. His current post will be filled by **William W. Conard,** former district manager for the southeastern states with L. H. Gilmer Co. before it merged with New York Belting and Packing Co. a year ago. Mr. Conard will make his headquarters in Atlanta. It was also announced that **Malcolm B. Roach,** sales engineer, has been appointed assistant manager for the southwestern district with headquarters in Dallas.

*Kenneth E. Knotts*
*K. E. Knotts Company*

**Kenneth E. Knotts,** formerly sales manager of Valvair Corp. has formed the **K. E. Knotts Company** representing C. A. Norgren Co, Hansen Mfg. Company, and Valvair Corp. Headquarters for this new company are at 106 Miln Street in Cranford, New Jersey. **Frank F. Blakeslee** and **Harold F. Verona** have joined the firm as field salesmen. Both men have wide experience in the pneumatic field.

**Modernair Corporation's** factory application and service staff has been augmented by the recent association of **Robert W. VeHorn,** formerly of the Rucker Company. Mr. VeHorn will be serving the Pacific Northwest and Rocky Mountain states as direct factory representative. In the eastern states area, **Sam D. Eubanks,** formerly of the A. J. Bayer Company of Los Angeles, will operate as direct factory representative, from a permanent eastern resident location. **William W. Burke** has joined factory sales department. Other organizational changes include **Harold R. Tucker** as office manager; **Shannon Murphy** as pro-


REPUBLIC AIRCRAFT
VALVES
BUILT TO
AN STANDARDS

Standard AN5829-2 Instrument Vacuum Control Valve and AN6204 Hydraulic Bleeder are built to AN specifications by Republic. Two Republic Hydraulic Bleeder Valves, No. 152 and No. 153, are of rising stem design, and are built for working pressures to 3,000 psi at temperatures from −65° to 180°F. Other items include wide range of needle, globe, check, relief, plug, and special valves, of aluminum alloy, stainless steel, and brass.

AN5829-2
Instrument Vacuum
Control Valve

*Write for complete catalog and nearest distributor.*

RM REPUBLIC MANUFACTURING CO.
1930 WEST 77TH STREET • CLEVELAND 2, OHIO

GET THESE FEATURES
IN ALL YOUR FUTURE
CYLINDERS

Hydraulic
High Pressure

★ Centrifugally Cast Cylinder Bodies
★ Cast Steel or Semi-Steel End Caps
★ Cast Iron Piston with Automotive Type Rings
★ Leakproof Packing. "O" Rings in each end cap
★ Adjustable Port Location
★ Fixed Cushions Standard Construction — Adjustable Cushions Optional

Air and Low
Pressure Hydraulic

★ Compact — No Tie Rods
★ Extra heavy walls of selected tubing
★ Metal to metal assembly preloads piston cups
★ Automatic rod packing requires no take-up. Seals under pressure
★ Aluminum alloy piston with steel cup retainer
★ Extra long rod guide

HYDRO-LINE CYLINDERS CONFORM TO J. I. C. STANDARDS

➡ *FREE Additional Data*

covering additional construction and performance features are included in this catalog. Write for your copy today. Ask for bulletin 350.

Hydro-Line
HYDRO-LINE MFG. CO.
705 19th Street
ROCKFORD, ILLINOIS




Circle 99 on Reader Service Card

Circle 152 on Reader Service Card

duction control and purchasing; **Michael Nolan** as plant foreman and **Marvin D. Combes** recently of California Research and Development, in charge of engineering and product development.

**H. R. Wilson,** a sales representative in Indianapolis district office of **Allis-Chalmers** general machinery division since 1948, has been named manager of the company's Rockford, Ill., branch office.

**Everett Gravenhorst** has joined the **Glenn L. Martin** Company as hydraulic design engineer. He came to Martin from Air Associates, Teterboro, N. J. where he had been supervisor of hydraulic engineering since 1948.

**Republic Aviation Corporation** has announced the appointment of **Ernest Wenigmann** as factory superintendent and **Ralph Bonafede** as assistant to the factory manager. Both men will be concerned with production of the F-84F Thunderstreak and the RF-84F, a photo-reconnaissance version of the swept-wing fighter bomber.

***J. J. McCarthy***
***Warner Division***
***Detroit Harvester Company***

Appointment of **J. J. McCarthy** as east coast sales manager of the recently acquired **Warner Division** of the **Detroit Harvester Company** was made by J. Thomas Smith, Detroit Harvester president. Mr. McCarthy was appointed by Jack P. Pedersen, division manager.

**Tube Turns, Inc.,** Louisville, Ky. has established a branch plant in Houston, Texas. The plant, in charge of **W. B. Whenthoff,** is at 7120 Katy Highway.

**Ray Kensel** has been named district sales manager for **Cleco Air Tool Division** of Reed Roller Bit Company for the Detroit, Cleveland, Cincinnati, and Indianapolis area, replacing **B. O. Stoothoff** who has resigned.

**A. B. Capron,** formerly chief engineer, has been named assistant works manager in charge of the tube mills and engineering, and **Newell Hamilton,** formerly superintendent of the steel mill, has been appointed manager of steel operations in the Tubular Products Division of The Babcock & Wilcox Company.


3 Advantages are YOURS if you use . .

UNIVERSAL
(THE ORIGINAL)
POROUS STONE
AIR FILTERS
IN YOUR COMPRESSED AIR LINES

A MILLION PORES are present in a 4" diam. stone—used in a ¾" size unit.

MADE FOR 6 PIPE SIZES
¼" ½" ¾" 1" 1½" 2"

1 Employ centrifugal action to secure complete separation of the larger particles of oil and water from compressed air and a minutely porous synthetic stone to remove the final traces of condensed water and oil.

2 They actually FILTER the air through the innumerable zig-zag pores of the stone of the tiniest particles of extraneous matter.

3 They're the EASIEST Filters to maintain. Simply remove one cap screw and loosen the other three, without disturbing the piping, and remove the stone for cleaning in oil solvent. The stones last indefinitely. Maintenance reduced to a minimum.

TWO STONES—2" in thickness but of varying diameters to fit different filter sizes—supplied with each Filter unit.

they INSURE PURE, DRY, OIL-FREE COMPRESSED AIR

Designed so that flow of air is UPWARD through the filter stone. When air is shut off the pull of gravity aids in drawing condensation and oil down to lower chamber for escapage through drain, hence stones require less frequent changing. Universal Air Filters are applicable to every type of industry.

The ORIGINAL Porous Stone Air Filter

UNIVERSAL FILTER CO., INC.
7021 MANCHESTER • ST. LOUIS 17, MO.

Name .....
Address .....
City ..... State .....

SEND THIS COUPON TODAY for COMPLETE INFORMATION

## Post Scripts of Industry

*Continued*

Appointment of **Paul J. Papanek** as eastern district manager for **Marquardt Aircraft Co.** was recently announced. Mr. Papanek will headquarter and be in charge of Marquardt's Dayton office.

*Frank X. Casone*
*James L. Entwistle Co.*

**Frank X. Casone** has recently been appointed director of hydraulics and pneumatics for **James L. Entwistle Co.**, Providence, R. I. Mr. Cascone has charge of the design, product development, research and sales of all fluid power components and equipment. He is presently chairman of the Education Committee of the National Fluid Power Association and is also secretary of the cylinder group of this association.

A new industrial expansion program is underway at the Mattoon, Illinois plant of the **Young Radiator Company.** Home offices and main plant of the heat transfer concern are located in Racine, Wis. Construction began with ground breaking ceremonies conducted late in June of this year, in which company president F. M. Young participated. The new construction involves 20,000 square feet, one-floor structure adjoining parent buildings in Mattoon.

**Lt. (j.g.) Carl W. Beck,** who was with **Lytle Engineering Company,** Cleveland, Ohio, from 1947 until his recall to active military service in March, 1952, has been discharged from the Navy and has rejoined Lytle Engineering.

**Greer Hydraulics Inc.** has completed negotiations with the New York Port Authority to permit construction of their new plant to be located at Idlewild Airport. The 155,000 square feet total area all under one roof will be divided up with 130,000 utilized for manufacturing and 25,000 set aside for office use. Hugh Lehnacker, vice president, manufacturing, estimates that the plant will be ready by March.

Fred T. Miller vice president of **Adel Division,** General Metals Corporation has announced a change in location of the Adel, Eastern, Mineola, Long Island, New York engineering office.


PROMPT SERVICE—LOW COST

**Flexible—Dependable**
**High, Medium And Low Pressure**
**HYDRAULIC HOSE ASSEMBLIES**

- **Flexible Hydraulic Control Lines.**
- **High Pressure, Wire Braided Hose Assemblies Withstand Flexing, Vibration and High Pressure Surges from 800 to 5,000 P.S.I.**
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***Phone—Fidelity 2-5445 (Phila.)***





Circle 30 on Reader Service Card

Circle 95 on Reader Service Card

New address is 290 Old Country Road, Mineola, L. I., New York. **J. Perry Barker** will continue to be in charge as eastern representative assisted as in the past by **E. M. Storer, Jr.**, as sales engineer.

***Don T. McKone, Jr.***
***Aeroquip Corporation***

**Aeroquip Corporation** of Jackson, Michigan, has recently added to its operating and storage facilities with the purchase of the Sterling Electric Motors plant in Van Wert, Ohio. **Don T. McKone, Jr.**, formerly assistant general manager of Aero-Coupling Corporation, Aeroquip's west coast subsidiary, will head the Van Wert plant as general manager. The new plant contains 45,000 square feet of space. Concurrent with the Van Wert announcement, Aeroquip also announces the addition of approximately 5500 square feet of floor space to the Aero-Coupling plant in Burbank, California.

To provide more space for their expanding operations in the Rocky Mountain area, **Alta Engineering Company**, has moved from 11650 Montview Boulevard to 1988 Nome Street, Aurora, Colorado. Aurora is a suburb of Denver. Alta Engineering Company continues to specialize in fluid power equipment sales. **Paul Locklin** heads this company.

**American Engineering Company**, Philadelphia, Pa., announces that **W. C. Miles** has been appointed assistant general


Circle 150 on Reader Service Card

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THE REID WAY

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BACK-UP
RINGS



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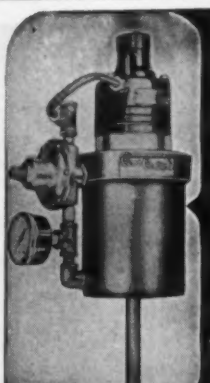

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The New B-50 Series of pneumatic cylinders for throttling control service operate on air pressures up to 100 psig and are capable of repositioning accuracies of 1/500 part of total stem travel. Simplified one-piece piston construction features graphite impregnated "O" ring seals and a piston positioner integrally mounted in the head plate. Extra sensitive, speedy and stable—because of minimum friction and precisioned aluminum design.

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- Pressure ring design permits head rotation to any pipe location.
- Precision fitted piston rings prevent by-pass while offering minimum friction.
- One piece high pressure, self-adjusting, rod packing provides precision bearing and guide for piston rod.
- Single or double end rods, with cushion.
- Other series available for air pressure.

*Write for Catalog AH*

NEPTUNE-POWER PLUS PRODUCTS CO.
2228 Bellevue Ave. Detroit 7, Michigan

Continued

manager. Mr. Miles has had extensive experience in the engineering field, especially in tool and jig design and production. He was formerly assistant to the vice president of manufacture at the Martin Aircraft Company and recently has been vice president and general manager of Skyline Corporation.

**Henry W. Fritz** has been appointed mid-west sales manager for the **Quijada Tool Division** of Gaines-Collins, Los Angeles.

T. O. Poe, president of **Poe Company** of Detroit, has announced the signing of a distributorship agreement with **Worthington Corporation** of Harrison, New Jersey. The agreement authorizes the Poe Company to sell, install, and service Worthington's line of vertical turbine pumps.

**The Heat-X-Changer Co., Inc.** of Brewster, N.Y. has announced the appointment of **G. M. Lovsted and Co. Ltd.**, Vancouver, B.C. as Canadian industrial products sales representatives in the Province of British Columbia and the Yukon Territory. Gordon W. Vennels, vice president and general manager, heads a sales staff of seven for the Lovsted Co.

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A prominent Cleveland, Ohio manufacturer is actively seeking engineers who wish to permanently associate with a progressive leader in the hydraulics and fluid system field. Some of the excellent openings are in:

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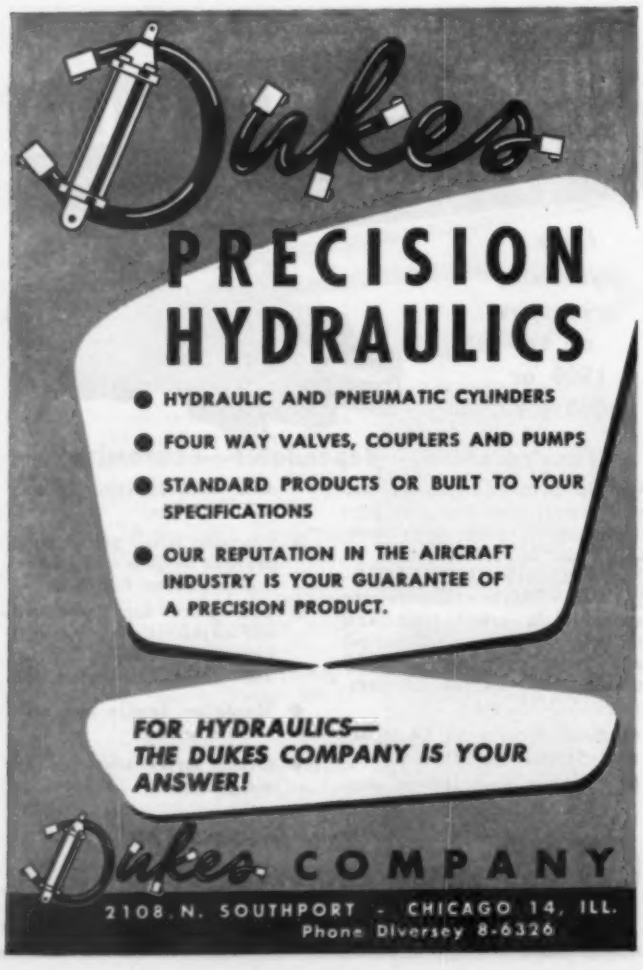
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Circle 56 on Reader Service Card

Circle 10 on Reader Service Card

Frank S. Schindler has been appointed assistant chief engineer of Fluid Controls, Inc., 1284 N. Center Street, Mentor,

***Frank S. Schindler***
***Fluid Controls, Inc.***

Ohio. This announcement was made by Donald A. Stark, secretary-treasurer and executive manager. He was associated with Brainard Steel Co., serving as chief engineer for five years. In 1945 he joined Flexonics Corp. and more recently, he was vice president in charge of production at Spencer Mfg. Co., Spencer, Ohio.

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German made by one of Europe's leading specialists in precision tools. Measures inside-outside & depth in .001" to 6" in 1000ths and 1/10mm to 150mm in 10ths. ..... 9.75
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Has 3-1/2 GPM capacity at 600 PSI. Motor is 1½ HP, 24V, D.C. Will operate on either 12 or 32V, DC current. Has built-in relief valve adj. to 1500 PSI. This unit ideal for hyd. lifts, portable loaders, etc. ..... 19.50
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Heavy duty, G.E. Gear Head motor. 2 HP, 24V. DC, 125 amp., reversible motor drives a reduction gear unit giving 36 to 1 ratio at take-off. Also will operate on 6 or 12 volts.
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A–3 VICKERS – 10" dia. Ball type. Built to stand 2000 P.S.I. 24.75
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Gives 20,000 lb. thrust (push or pull) using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lb. thrust with 3000 PSI. Can also be used on low pressure air systems. 4" bore; 18" stroke; 30½" length. Ideal for road form – shop machinery.
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***Hydraulic***
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***Features***

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★ Grey Cast Iron Body

**Series D.R. Relief Valves are available in three pressure ranges.**

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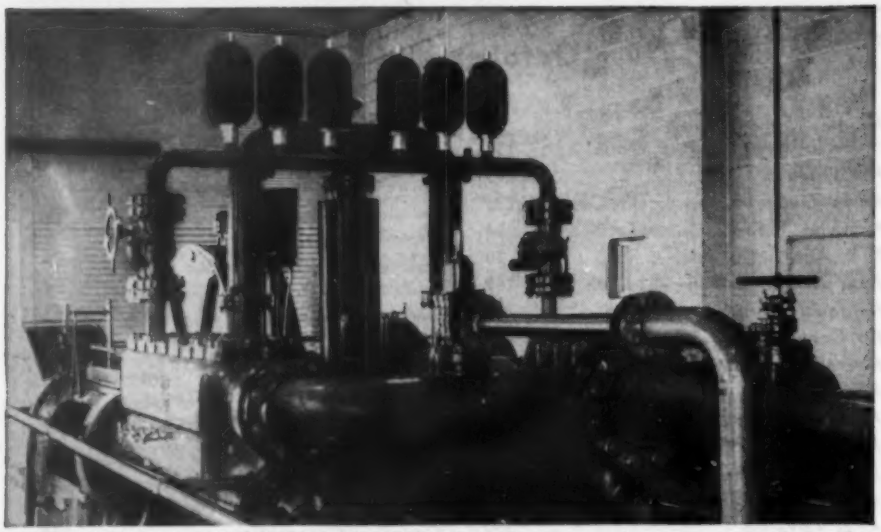
628 Colfax Ave. N. Dept. H-103 Minneapolis 11, Minn.

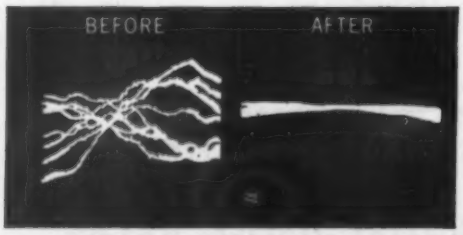
# GREER TOPICS

**Functions and Applications of the Greer Accumulator**



PORTLAND PIPELINE CORPORATION engineers no longer worry about the problem of pump pulsations since Greer accumulators were installed on their equipment. Pressure surges from reciprocating pumps were rendered harmless. See below.

# How Greer Accumulators Reduce Pump Pulsations




PROOF POSITIVE! Hydrauliscope photographs, taken before and after the installation of Greer accumulators, give conclusive evidence that pump pulsations were reduced more than 67% for Portland Pipeline pumping equipment. Write or call Greer now for special Bulletin 500 that gives complete technical data and diagrams on pump pulsation problems and corrections.

## Actual hydrauliscope tests prove pressure surges can be reduced as much as 90%

The most common cause of pipeline and hydraulic system failure can be traced to the dangerous pulsations of reciprocating pumps. A positive remedy for this hazard is the versatile Greer Hydro-Pneumatic Accumulator.

This compact power package, with its unmatched ability to absorb shock, renders pump pulsations harmless. The result is a smooth, steady flow of fluid so vital to efficient hydraulic operation.

Are you troubled with a pump pulsation problem? Then let our experienced hydraulic engineers demonstrate how costly downtime can be avoided, how performance and production can be improved, how equipment can be given longer life with the installation of a Greer accumulator. Write or call today.

## Greer Hydro-Pneumatic Accumulators have many other diversified functions

(1) Pressure storage chamber for main, auxiliary and emergency power (2) Pressure-volume compensator for leakage and temperature (3) Dispenser of fluids and lubricants (4) Transfer-barrier for fluids and gases (5) Shock absorber for line shock and pump pulsation.

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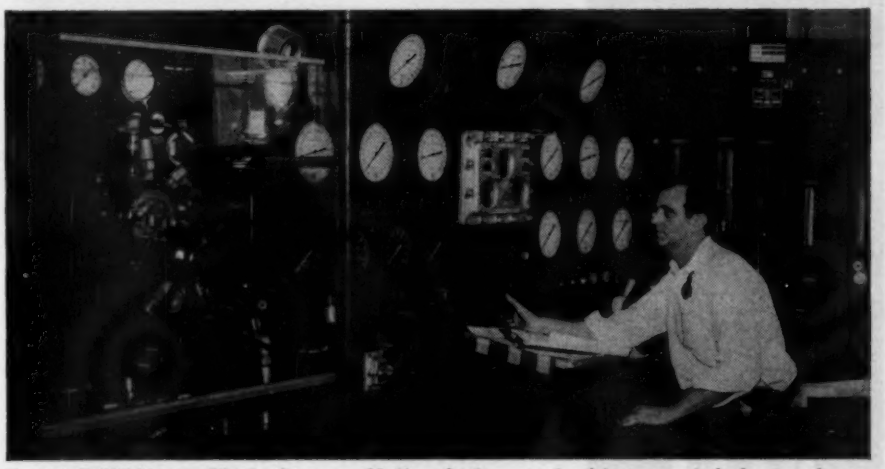
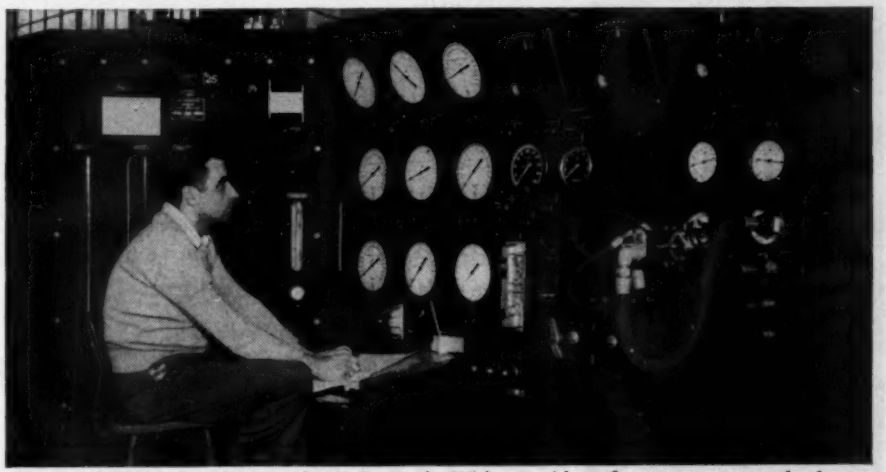
# GREER TOPICS

**Important News of Aviation & Industrial Test Equipment**



**Pratt & Whitney Aircraft** tests Holley fuel control with test stand shown above. This like other equipment on this page, was designed and built to order by Greer Hydraulics in close collaboration with Pratt & Whitney Aircraft and Greer's special staff.



**To test fuel pressurizing valves,** Pratt & Whitney Aircraft uses test stand above, designed and built by Greer to Pratt & Whitney specifications. In addition to this designed-to-order equipment, Greer produces an entire line of standard test machines.

**After-burner fuel control** is checked on this Greer test stand. Aircraft manufacturers like Pratt & Whitney Aircraft know that Greer equipment means highest order accuracy and dependability. The stands are designed and built by men with many years of experience in this very specialized field. Call or write Greer today to help solve your test and maintenance problems.

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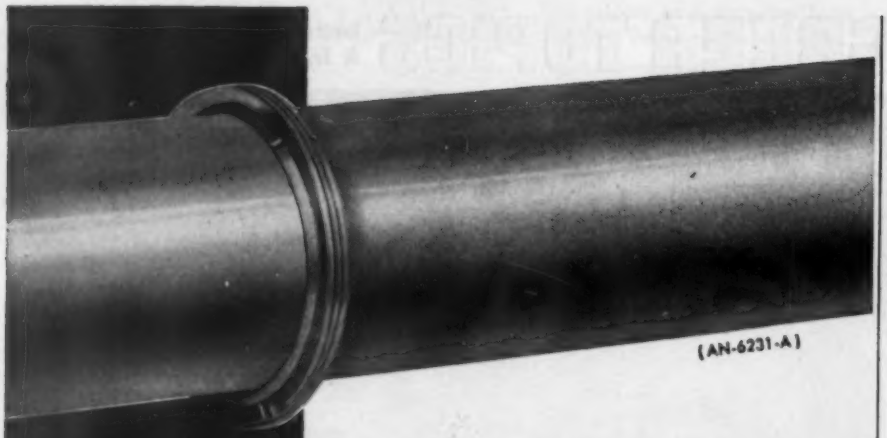
(AN-6231-A)

# KEEP DIRT OUT!

Dirt means *down-time* for your hydraulic equipment! Dirt means damage to packings, cylinder walls and internal parts. STOP LOST PRODUCTION due to constant replacement of packings. Keep dirt out with HYDRO-WYPE Scraper Rings, and you keep your equipment at peak efficiency longer. HYDRO-WYPES are precision-made for the precision-fit that keeps piston rods clean for more than 2,000,000 cycles—and at low cost, too. They meet or exceed the requirements of MIL-S-5049. Check these HYDRO-WYPE features:

★ **Sharp, clean scraping edges!**

★ **99% to 99.5% rod contact!**

★ **"Pre-Stressed" for controlled break-out friction!**

★ **Approved Specification MIL-S-5049!**

★ **Precision-fit!**

HYDRO-WYPES are widely used today by manufacturers of machine tools, aircraft and marine equipment, power steering units, railroad and road-building equipment, farm machinery—in all types of **hydraulic** and mechanical components.

Look for the HYDRO-WYPE decal when you buy hydraulic and pneumatic equipment. You can tell the quality of a product by the company it keeps.

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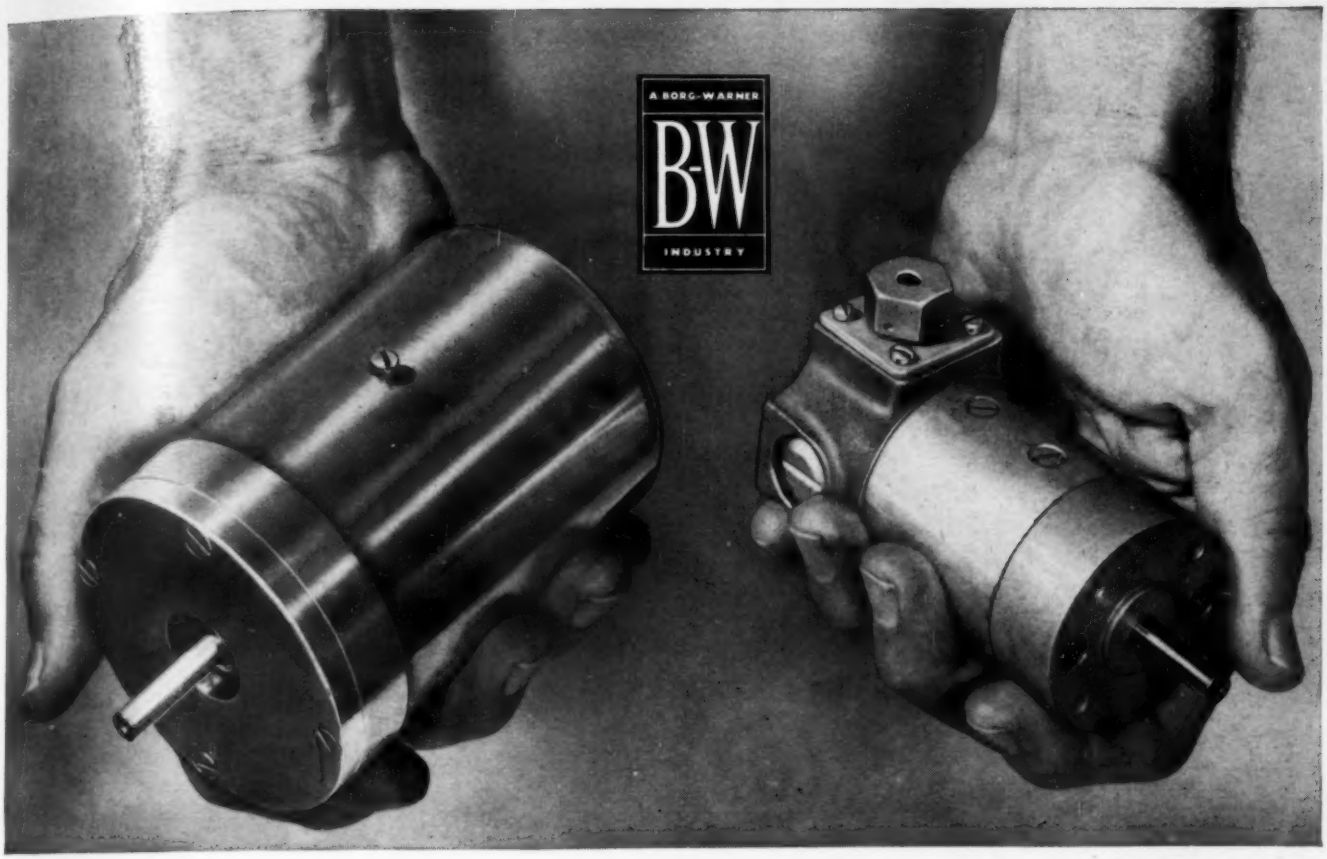


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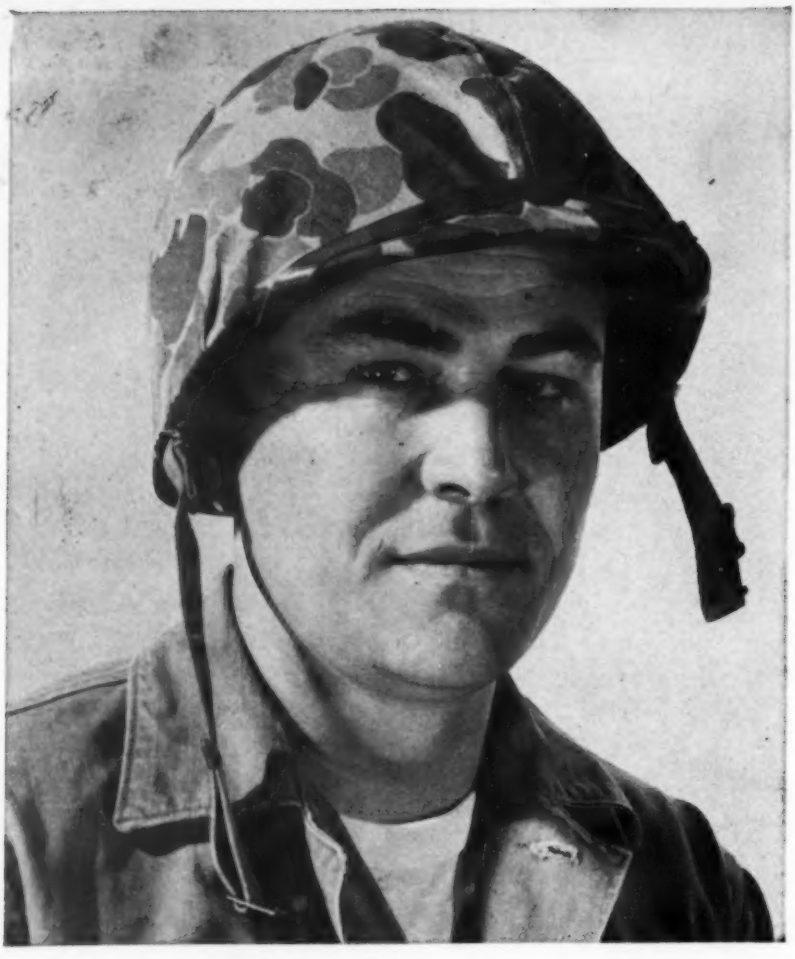
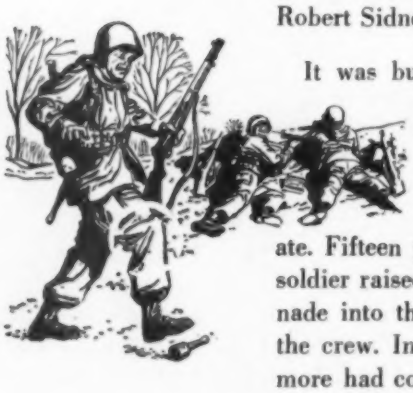


*Technical Sergeant*
*Robert S. Kennemore, USMC*
*Medal of Honor*

# Under His Foot, the Live Grenade

THE MACHINE GUN belonged to E Company, Second Battalion, Seventh Marines. It was under the command of Technical Sergeant Robert Sidney Kennemore.



It was busy. For on this Novmber night fanatical Red masses were swamping Marine defense positions north of Yudam-ni.

Fighting was close and desperate. Fifteen yards in front of the gun, a Red soldier raised his body briefly and sent a grenade into the air. It landed squarely among the crew. In a split second, Sergeant Kennemore had covered it with his foot.

There was a violent, muffled explosion, but not a man was hurt. Not a man except Sergeant Kennemore. He had given both his legs to save his comrades' lives.

"When I was on active duty," says Sergeant Kennemore, "I sometimes wondered if people back home cared as much about stopping Reds as we did. Now that I'm a civilian, I know they do. And one proof is that so many of my neighbors are investing in E Bonds for our country's defense. Believe me, I know how important that defense is. So I'm investing too, just as I hope you are!"

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